Partnership Meeting

Agenda

Wye Catchment Nutrient Management Board

Date:	**Monday 6 July 2026**
Time:	**2.00 pm**
Place:	**Conference Room 1 - Herefordshire Council, Plough Lane Offices, Hereford, HR4 0LE**
Notes:	For any further information please contact: nutrientmanagementboard@herefordshire.gov.uk

If you would like help with this document, or would like it in another format, please email nutrientmanagementboard@herefordshire.gov.uk in advance of the meeting.

Agenda for the meeting of the Wye Catchment Nutrient Management Board

Voting membership

Chairperson	Councillor Elissa Swinglehurst	Herefordshire Council
	Merry Albright	Herefordshire Construction Industry Representative
	Liz Bickerton	Bannau Brycheiniog National Park Authority
	Louise Bodnar	Voice of the River
	Councillor Jackie Charlton (Vice-Chairperson)	Powys County Council
	Helen Dale	Country Land and Business Association
	Nick Day	The Friends of the Lower Wye
	Simon Evans	The Wye and Usk Foundation
	David Gillam	Save the Wye
	Gordon Green	Wye Salmon Association
	Saul Herbert	Herefordshire Wildlife Trust
	Christine Hugh-Jones	Council for Protection of Rural Wales
	Georgie Hyde	National Farmers Union
	Sarah James	Farm Cymru
	Councillor Catrin Maby	Monmouthshire County Council
	Councillor Andrew McDermid	Forest of Dean District Council
	Andrew McRobb	Council for Protection of Rural England
	Silvia Sivers	Radnorshire Wildlife Trust
	Pat Stirling	Friends of the Upper Wye

Agenda

Pages

1. APOLOGIES FOR ABSENCE

To receive apologies for absence and to note any substitutes.

2. NOTES OF THE PREVIOUS MEETING 5 - 12

To receive the notes of the meeting held on 29 April 2026.

3. QUESTIONS FROM MEMBERS OF THE PUBLIC

To receive any written questions.

4. RIVER LUGG SSSI CONDITION ASSESSMENT 13 - 168

To receive a presentation covering the following Natural England documents:

i. River Lugg SSSI Condition Assessment (2026) (agenda page 13)

ii. Landowner Summary Note - Update on the Condition of the River Lugg SSSI (agenda page 165)

iii. Landowner Infographic – Go With The Flow, Improving SSSI river condition (agenda page 167)

[Claire Minett, with Daisy Burris and Gertruda Zieniute, Natural England; 40 minutes]

5. REVIEW OF AN N TARGET FOR THE RIVER WYE To Follow

To receive an update on the review.

[Claire Minett, Natural England; 5 minutes]

6. DWR CYMRU WELSH WATER UPDATE To Follow

To receive an update on the recent Ofwat investigation (and how it relates to Dŵr Cymru Welsh Water assets in the catchment).

[Dan Humphreys, Dŵr Cymru Welsh Water; 10 minutes]

7. WYE CATCHMENT MANAGEMENT PLAN AND NUTRIENT MANAGEMENT PLAN - UPDATE 169 - 172

Update on progress to date and next steps.

[Gemma Dando, Herefordshire Council; 10 minutes]

8. STATUTORY OFFICERS' GROUP REVIEW To Follow

Update on progress with the review.

[Gemma Dando, Herefordshire Council; 10 minutes]

9. ITEMS FOR INFORMATION FROM THE STATUTORY AGENCIES

The following Environment Agency updates are highlighted for information:

- River Wye Data Analysis Report (2025) available through River Wye Water Quality | Engage Environment Agency (link)

- High-level findings of Project TARA (To Follow)

[Note: Due to the rescheduling of this meeting, Martin Quine (Environment Agency) is unable to attend on this occasion]

10. WIDER UPDATES FROM MEMBERS OF THE BOARD

To receive updates on activity from members of the Wye Catchment Nutrient Management Board.

[Board members and other participants; 5 minutes]

11. DATE OF NEXT MEETING

The next meeting is scheduled for: Wednesday 7 October 2026, 2.00 pm.

The agenda for the October meeting is likely to include an update on the Wye Catchment Living Labs Programme from the University of the West of England (UWE Bristol).

Notes of the meeting of Wye Catchment Nutrient Management Board held in Conference Room 1 - Herefordshire Council, Plough Lane Offices, Hereford, HR4 0LE on Wednesday 29 April 2026 at 2.00 pm

Chairperson:

Councillor Elissa Swinglehurst	Herefordshire Council

Voting members present in person:

Liz Bickerton	Bannau Brycheiniog National Park Authority
Louise Bodnar	Voice of the River
Gordon Green	Wye Salmon Association
Andrew McRobb	Council for Protection of Rural England
Pat Stirling	Friends of the Upper Wye
Rosie Wilson	Herefordshire Wildlife Trust

Voting members in attendance remotely:

Helen Dale	Country Land and Business Association
Christine Hugh-Jones	Council for Protection of Rural Wales
Georgie Hyde	National Farmers Union
Sarenta King	Radnorshire Wildlife Trust
Councillor Catrin Maby	Monmouthshire County Council
Councillor Chris McFarling	Forest of Dean District Council

Other participants present in person:

Gemma Dando	Herefordshire Council
Daniel Humphreys	Dwr Cymru/Welsh Water
Claire Minett	Natural England
Martin Quine	Environment Agency
Dan Smith	Herefordshire Rural Hub
Kate Speke Adams	Herefordshire Rural Hub
Rosanna Willmott	Herefordshire Council

Other participants in attendance remotely:

Craig O'Connor	Monmouthshire County Council
Ann Weedy	Natural Resources Wales
Bradley Willson	Herefordshire Council

Support officers:

Ben Baugh	Herefordshire Council
Matthew Evans	Herefordshire Council

37. APOLOGIES FOR ABSENCE

The Chairperson welcomed the attendees and explained that the meeting was being recorded by Eighty Sita Productions for a film project about the Charter for the River Wye.

The following apologies for absence (and substitutions) were recorded:

- Merry Albright, Herefordshire Construction Industry Representative
- Councillor Jackie Charlton, Powys County Council

- Nick Day, The Friends of the Lower Wye
- Simon Evans, The Wye and Usk Foundation
- Saul Herbert, Herefordshire Wildlife Trust (Rosie Williams was present as a substitute)
- Councillor Andrew McDermid, Forest of Dean District Council (Councillor Chris McFarling was present as a substitute)

38. NOTES OF THE PREVIOUS MEETING

The notes of the previous meeting held on 21 January 2026 were agreed.

With reference made to note 31 (Diffuse Water Pollution Plan Update) paragraph n., it was noted that a response was awaited in relation to the query 'whether the number of Ground Water Source Protection Zones within the English portion of the catchment, as referenced at page 67 of the DWPP, had resulted in guidance being issued.'

[Note: subsequent to the meeting, a response was provided to the Chairperson by Martin Quine; available here Matters arising from the meeting held on 29 April 2026]

39. QUESTIONS FROM MEMBERS OF THE PUBLIC

Attention was drawn to the questions and responses document published in advance of the meeting; available here Questions and responses received, as at 29 April 2026 (link).

40. NUTRIENT MANAGEMENT PLAN (NMP) - INTRODUCTION OF APPROACH

Oliver Bowers (Haskoning UK Ltd) reported on progress with the development of the Wye Catchment Management Plan (CMP) and how it related to the Nutrient Management Plan (NMP). The principal points included:

1. An evidence review was underway, involving the collation of data and other information sources, to develop an evidence-led report that would identify the key issues and pressures within the catchment.

2. There would be an options assessment which would also explore synergies in relation to potential solutions.

3. An overall options appraisal would be conducted to develop a shortlist of solutions, supported by modelling, with the overall aim of attaining favourable condition.

4. Four key themes were identified: flooding, geomorphological constraints, water quality, and ecology.

5. There were ten sub-catchments, with some areas further subdivided to facilitate more detailed analysis where required.

6. The action plan would need to be implementable and include defined timescales, potential funding opportunities, assigned responsibilities, and monitoring arrangements. It was noted that data gaps may be identified and the action plan would address this, including consideration of feasibility studies where applicable.

7. It was anticipated that the CMP would span approximately ten years, with periodic updates scheduled.

8. It was intended that the options assessment would be completed by the end of summer 2026, followed by a period of stakeholder engagement.

9. The evidence base, modelling, and framework of the CMP would be utilised to develop a standalone NMP, incorporating relevant levels, targets, and bespoke elements. It was noted that there was a need to quantify and account for significant new housing growth in the catchment.

10. The team involved in the development of the CMP would be mostly the same for the subsequent development of the NMP.

In response to questions from the Chairperson, Oliver Bowers acknowledged the need to look at: evidence in terms of phosphate and total phosphorus; levels of ammonia; the condition assessments of the Wye and Lugg being conducted by Natural England, as well as the Welsh Evidence Base. The Chairperson highlighted the general principle moved at the previous meeting that 'the new Nutrient Management Plan, as and when it was scoped and designed, needed to at the least accord with the legally binding targets'; note 30 of 21 January 2026 refers (link).

Liz Bickerton commented on the need for action plan timings to align with budget cycles. In response to a question, Oliver Bowers indicated that, while additional modelling, engagement and adoption processes would be necessary, there should not be a substantial time gap between the CMP and the NMP.

In response to a question from Kate Speke Adams, it was reported that WSIMOD (Water System Integrated Model) would be utilised for water quality modelling given the scale of the catchment.

Helen Dale commented that consultation and engagement activities should include the broader agricultural sector. It was confirmed that an engagement plan was being developed. The Chairperson said that the board was the obvious route for consultation and engagement.

In response to a question from Pat Stirling, Claire Minett reported that the condition assessment for the Lugg had been largely completed, with work continuing for the Wye; this evidence would be appraised to determine if a nitrogen target was appropriate.

In response to a question from Christine Hugh-Jones, it was confirmed that the entirety of the catchment would be covered.

The Chairperson thanked Oliver Bowers and requested that the board receive ongoing updates regarding progress.

41. THE UNIVERSITY OF THE WEST OF ENGLAND (UWE BRISTOL) HAS BEEN AWARDED £1 MILLION TO LEAD RESEARCH INTO AGRICULTURAL POLLUTION IN THE RIVER WYE

Dr Rounaq Nayak (Senior Lecturer in Farming Systems, UWE Bristol) briefed the board. The principal points included:

i. UWE Bristol had been awarded funding in April 2026 for the three-year research project.

ii. The project would work directly with farmers to test the effectiveness of interventions and to generate evidence to inform policy development for the Wye, and for catchment programmes nationally.

iii. There would be a 'living labs' approach to co-design solutions, delivered in partnership with Hartpury University and Hartpury College, with the engagement of farmers and other stakeholders in the catchment.

iv. The first phase would include participatory workshops over the next five months.

In view of the interconnected nature of the various projects and initiatives within the catchment, the Chairperson commented on the importance of establishing effective information flow to the Nutrient Management Board and to the Wye Catchment Partnership.

In response to a question from Councillor McFarling, Rounaq Nayak said that farm selection criteria were to be defined and would be informed by the findings of the participatory workshops and assessment of the feasibility of potential interventions.

It was noted that there would be engagement with farmers in both England and Wales.

Louise Bodnar, as the Voice of the River, expressed concern that the framing for the project appeared to be around the feasibility of interventions for farming businesses rather the needs of the Wye and the species and habitats dependent upon it; adding that adjustments to 'business as usual' would not be enough to solve the problems for the river. Rounaq Nayak said that the participatory workshops would engage a diverse range of stakeholders and facilitate candid conversations about the issues.

Pat Stirling noted the need for due diligence within the project but felt that the opportunity should not be missed to share evidence and understanding obtained through the work on the Wye Catchment Management Plan.

It was noted that Rounaq Nayak was due to meet with the Wye Catchment Partnership at the end of May 2026.

Helen Dale commented that the Country Land and Business Association and the National Farmers' Union could assist with farmer and landowner engagement.

The Chairperson thanked Rounaq Nayak and noted that board members were keen to engage with the project as it moved forward.

[Note: subsequent to the meeting, a briefing note was provided; available here Wye Catchment Living Labs Programme (link)]

42. NUTRIENT BALANCE PROJECT

Dan Smith (Hub Farm Facilitator, Herefordshire Rural Hub) delivered the presentation Wye Nutrient Balance Pilot Programme (link) with the slide headings: Pilot programme; Nutrient imports by category; Nutrient exports by category; Nutrient balance kg/ha, and Import vs Export; Nutrient load scenarios; What next?; and Garnstone Farms – Case Study Nutrient Balance 2022, and 2024.

The Chairperson commented on the value of the project in adding data, granularity, and understanding on a farm by farm basis which would be key to identifying the right actions. It was suggested that sharing further details on the changes to the business in the identified case study would be beneficial. Dan Smith said that the case studies were going to be developed further and in accessible formats, including videos.

In response to a question from Andrew McRobb, Dan Smith commented on some of the factors that had impacted on nutrient balance, and emphasised the importance of engagement with farmers and knowledge exchange.

Pat Stirling noted the environmental and financial benefits of reducing imported fertilisers. In response to a question about soil testing, Dan Smith drew attention to the next agenda item and commented on the utility of increasing the 'tools within the box' to provide tangible answers and to bring about effective change.

In response to questions from Louise Bodnar, Dan Smith clarified that pilot was undertaken in two years, and commented on engagement with the supply chain, including conversations outside of the catchment.

In response to a further question from Pat Stirling, Dan Smith said that the nitrogen figures were unexpectedly high but, as excesses could be quantified in budgeting terms, increased understanding could be a potential driver for behavioural change. Kate Speke Adams observed that the situation illustrated the limitations of regulatory approaches alone, as nutrient excesses through livestock feed had been overlooked for many years. Pat Stirling emphasised the need to work together for the benefit of the environment and for industries in the catchment.

The Chairperson thanked Dan Smith and noted that it was important for the board to look at nitrogen, as well phosphate and total phosphorus.

43. UNLOCKING SOIL LEGACY PHOSPHORUS: IMPROVING NUTRIENT MANAGEMENT THROUGH TOTAL PHOSPHATE SOIL TESTING IN THE WYE CATCHMENT

Kate Speke Adams (Herefordshire Rural Hub) delivered the presentation Total P Testing Pilot (link), with the slide headings: Background and rationale; Approach taken; Key findings; More questions than answers…; and What next?. The agenda pack included the paper Total Phosphorus Soil Testing Pilot - Project Report (link).

The Chairperson made a number of comments, including: the project was commended and the participants were thanked for their contributions; multiple related strands of research and work were emerging which needed to be joined up, such as collaborative efforts in terms of location testing; and there was a need to look at issues holistically, including the significance of nutrient accumulation.

Louise Bodnar commented on established scientific principles in terms of how legacy phosphate could be accessed for soil health enhancement and queried whether this could be communicated to farmers. Kate Speke Adams commented that many farmers were adopting regenerative practices and had active soils, but there were limitations in quantifying the effects of measures in the short-term and, given the urgency around river water quality, there was a need to understand what should be prioritised. There was a brief discussion about interrelating factors and ways to deliver the most effective results. Dan Smith acknowledged the importance of holistic approaches but noted that outcomes also depended on specific management decisions in relation to local soil types.

The Chairperson commented on opportunities to deliver both environmental and financial benefits.

44. GYPSUM FOR PHOSPHATE RETENTION IN SOIL

Rosie Willmott (Herefordshire Council) delivered the presentation Gypsum: Reducing Phosphate Loss in Herefordshire Soils (link), with the slide headings: Gypsum; International evidence base; Rapid analysis of Herefordshire soils; Outcomes; and Next steps. The agenda pack included the paper The effects of gypsum application to agricultural soils on water extractable phosphorus (link).

The Chairperson thanked Rosie Willmott for the presentation, Ben Taylor-Davis for highlighting the concept, and the farmers for their involvement in the research. Whilst recognising that this project involved a lab based trial, it was noted that the outcomes were very encouraging.

In response to questions, Rosie Willmott explained the next steps, including working with Lancaster University and a consultant to undertake a field scale trial from the autumn, and acknowledged that the articulation of co-benefits should be a key principle in engagement with the farming community.

Pat Stirling commended the approach and the early results, but emphasised that phosphorus was not the only issue affecting river health (e.g. nitrogen, ammonia, and sediment) and encouraged statutory agencies to adopt an integrated approach. Claire Minett said that the whole picture was fundamental for the solutions, and consideration would be given to new evidence and research, but phosphorus remained a significant issue, particularly for the Lugg. Ann Weedy said that the need to approach river health holistically was recognised, and commented on nutrient levels in Wales.

Georgie Hyde highlighted recent permitting changes for storing and spreading gypsum.

Andrew McRobb also commented on the issues with high levels of nitrate and the need for broad perspectives given the evolving information.

45. UPDATES FROM THE RIVER WYE STATUTORY OFFICERS' GROUP (SOG)

Gemma Dando reported that, following feedback from the board about the information provided to the Nutrient Management Board (NMB), the SOG had met to explore its future role, particularly in the context of the emerging Nutrient Management Plan. It was noted that consideration was being given to its purpose, terms of reference, and membership. It was proposed that representatives of the NMB and the SOG meet before the next board meeting to advance this work.

Andrew McRobb, Pat Stirling, and Councillor Swinglehurst volunteered to support this activity; Merry Albright expressed interest following the board meeting.

46. WIDER UPDATES FROM MEMBERS OF THE BOARD

Board members provided the following verbal updates:

- The Chairperson advised that, further to the Herefordshire Council motion in December 2025, The Charter for the River Wye (link) would be launched formally at an event on 24 May 2026 in Hay-on-Wye. Board members and other participants were encouraged to attend.

  It was noted that a governance process was underway in Powys to seek support for the adoption of the Charter.

- Martin Quine reported that the River Wye Data Analysis Report 2025 would be released shortly.

  [Note: the report was published on 6 June 2026; available here Engage Environment Agency: River Wye Water Quality webpage (link)]

  Martin Quine also reported on: the appointment of an agricultural enforcement lead for the West Midlands; and the early stages of a Fixed Monetary Penalties (FMP) trial.

  [Note: subsequent to the meeting, further detail about the FMP trial was provided to the Chairperson by Martin Quine; available here Matters arising from the meeting held on 29 April 2026 (link)]

- Louise Bodnar commented on a case study conducted in Denmark regarding the mitigation of river pollution through multiple mechanisms, including livestock reduction and nutrient regulations, and how these findings could inform the development of measures or trading schemes through the Wye Catchment Management Plan and Nutrient Management Plan.

- Ann Weedy reported that Natural Resource Wales had recently updated guidance on Silage, slurry and other livestock manure storage (link), and that funding had been secured for a new role in the Upper Wye Catchment Restoration Team to support engagement and targeted campaign work over the twelve months.

- The Chairperson said that updates would be provided by Herefordshire Council, including information about progress with the Herefordshire Local Nature Recovery Strategy (LNRS); available here Matters arising from the meeting held on 29 April 2026 (link).

- Andrew McRobb reported that the Hedgerow Heroes project had worked with 18 farms in Herefordshire to plant and restore approximately 10km of hedgerow during the planting season.

47. DATES OF FUTURE MEETINGS

The schedule of future meetings was noted, as follows:

~~Wednesday 24 June 2026, 2.00 pm~~ [moved to Monday 6 July 2026, 2.00 pm]
Wednesday 7 October 2026, 2.00 pm
Wednesday 20 January 2027, 2.00 pm
Wednesday 3 March 2027, 2.00 pm
Wednesday 7 July 2027, 2.00 pm
Wednesday 6 October 2027, 2.00 pm

The meeting ended at 4.02 pm **Chairperson**

River Lugg SSSI Condition Assessment (2026)

An assessment of the 'Rivers & Streams' & 'Otter' features

Date: 06th February 2026

Version: 1

Contents

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Author(s)

Daisy Burris - Senior Freshwater Monitoring Officer, Natural England

Katie Russell - Hydrologist, JBA (Flow Assessment)

Joshua Smith – SSSI Monitoring Officer, Natural England (Macroinvertebrate assessment)

Foreword

In 2023 Natural England published an updated condition assessment of the River Lugg SSSI based on a partial assessment of attributes, utilising desk-based information sources. The 2023 assessment downgraded the condition from Unfavourable - Recovering to Unfavourable – Declining. A full assessment was required to explore the factors contributing to this decline.

Natural England's West Midland Area Team commissioned the SSSI Monitoring & Evaluation Team in 2024 to undertake an updated full Common Standards Monitoring assessment of the River Lugg SSSI.

The assessment draws on more than forty years of monitoring records, technical reports and evidence reviews, supported by two weeks of field surveys completed in July & September 2025. Together, this evidence has informed the evaluation of the River Lugg's current conservation status and has clarified the priority actions needed to support its recovery and progress towards favourable condition.

This assessment is intended to provide a clear, evidence-based foundation for that shared effort. It identifies the key challenges, highlights where action is most urgently needed and sets the direction for future restoration. Above all, it reflects our ongoing commitment to protecting and improving one of the region's most important rivers, not only for the wildlife it supports, but for the communities that value it.

Executive summary

The River Lugg is an important river in England for wildlife, protected as a Site of Special Scientific Interest (SSSI). It was originally designated as an exceptionally good example of a river which transitions from high to low nutrient status, supports a rich mix of aquatic plants, and provides vital habitat for otters.

This assessment brings together evidence from a wide range of sources, including recent surveys, river flow modelling and water quality analysis. It provides the first full condition assessment since 2010.

Overall condition: Unfavourable – Declining

The River Lugg is not meeting the standards required for a healthy, naturally functioning SSSI river. Across all four assessment units, indicators show that conditions have worsened in recent years. The main reasons for decline are:

- **Too much phosphorus (nutrient pollution)**
- **Excess fine sediment (siltation)**
- **Invasive non-native species, especially Himalayan Balsam and Signal Crayfish**
- **Increasing pressure from Climate Change**

Some aspects of the river are in favourable condition including the flow regime, dissolved oxygen levels and the continued presence of otters. The site retains high ecological value and good aquatic plant species diversity.

Key Findings

Flows

A natural flow regime is fundamental for a healthy river. River flows are generally close to natural across the SSSI. All units met flow compliance targets between 2019–2024, with only short, minor low-flow failures recorded in the upper catchment during drought conditions. Overall, the influence of abstractions and discharges on the flow regime are not considered a primary driver of current ecological condition.

<u>Recommendation</u>: no further action is required to achieve flow compliance.

Water Quality

Water quality is one of the most serious problems affecting the River Lugg. Water quality is failing from the top to the bottom of the catchment, and all monitoring locations exceed the phosphorus targets required for favourable condition.

High phosphorus levels cause:

- excessive algal growth
- reduce water clarity
- shift plant and invertebrate community compositions
- heighten risk of oxygen crashes and fish kills

Nutrient enrichment is a significant driver of ecological decline across the catchment.

Recommendation: addressing water quality requires co-ordinated action between England and Wales to tackle pollution at the catchment scale. Measures should reduce phosphorus loading through addressing both the sources and pathways. Measures to reduce phosphorus inputs include improved on farm nutrient efficiency and upgrades to wastewater treatment works. Refer to the Diffuse Water Pollution plan for a comprehensive list of measures.

Physical Habitat

Channel Planform

In many places the river retains a naturally meandering form. The upper reaches in particular follow a largely natural course and exhibit healthy geomorphological processes.

Habitat Modification

However, the river has been modified over many decades, particularly around and downstream of Leominster, where:

- the channel was dredged
- banks were raised or straightened
- sections are now disconnected from their floodplain

These changes slow the river, trap sediment, reduce habitat diversity, and limit natural processes.

Recommendation: physical channel restoration to re-establish floodplain connectivity and restore over deepened and embanked channels should be investigated on a reach-by-reach basis.

Fine Sediment (Siltation)

Siltation is extensive in the middle and lower river. Over half of surveyed sites recorded major impacts from silt. Siltation impacts result in:

- smothering of gravel beds

- reduced spawning habitat for fish
- reduced diversity of aquatic plants and invertebrates

Silt likely comes from a mix of field drains, eroding banks, over-deepened channels, and land management practices.

Recommendation: understanding the sources of sediment through a sediment fingerprinting study is required to systematically address sedimentation impacts. No regret actions including drain blocking and floodplain conversion from arable to grassland should be initiated.

Large Woody Debris

The river is well-lined with trees, and the presence of woody material provides valuable habitat and complexity. However, tree age is often uniform, which poses a risk to the long-term functioning of the riparian corridor.

Recommendation: riparian woodland creation is recommended along targeted reaches of the corridor.

In-channel structures

- Numerous weirs restrict natural flow, block fish movement, and cause sediment to accumulate.
- Most weirs upstream have no functioning fish pass.

Recommendation: implement the weir removal & modification strategy.

Riparian Zone and Land Use

- Across much of the river, intensive land use, especially arable cropping and improved grassland extend right up to the river edge. This reduces natural buffers, increases soil and nutrient runoff, and limits ecological functioning.
- Only a few sections, mostly where semi-natural floodplain grassland or woodland remain, provide good riparian habitat.

Recommendation: Large-scale conversion of arable land in the floodplain to low-intensity grazing or semi-natural habitat is required.

Plants and Algae

The river’s aquatic plant community is showing clear signs of nutrient stress:

- high filamentous algae cover (often 20–60%)
- fewer sensitive species in many reaches

- elevated nutrient index scores

Although species richness remains similar to historic levels, the shift towards algae-dominated communities indicates decline.

Recommendation: restoring the plant community will require physical habitat restoration and nutrient pressure reduction. See recommendations for water quality and physical habitat.

Macroinvertebrates

- Macroinvertebrate data shows a mix of Good and High status in some reaches, but not consistently enough to meet favourable condition.

- Low diversity scores in several units indicate impacts from sediment, nutrients, and habitat quality, even where organic pollution is low.

Recommendation: restoring the macroinvertebrate community will require physical habitat and water quality improvements. See recommendations for water quality and physical habitat.

Otters

- Otters were recorded in all units, with spraint, prints and feeding signs found during most surveys. Suitable resting and foraging habitat remains widespread.

- However, long-term resilience of otters depends on improving the river's water quality and fish populations.

Recommendation: restoring the river habitat through the recommended measures listed above will ensure the River Lugg is resilient, providing high quality habitat for a thriving otter population.

Overall Conclusions

The River Lugg SSSI is in **unfavourable condition and is showing signs of decline**. The river faces multiple, interacting pressures from nutrient enrichment, siltation, physical modification, and invasive species which together undermine its ecological functioning.

Climate change is likely to result in warmer temperatures, prolonged droughts & heavier rainfall, which amplifies existing pressures.

Despite these challenges, the Lugg retains significant natural value, especially in its upper reaches, and shows clear potential for recovery with the right actions.

Recommendations for Improving the River

To restore the River Lugg to favourable condition, the report identifies several priority actions:

1. Reduce phosphorus inputs across the catchment

- Address agricultural nutrient runoff through changes to land management practices.
- The planned works from Dwr Cymru to make further improvements to waste water treatment work is welcomed. However, catchment-wide nutrient management is required which should address all pollution sources including combined-sewer overflows and rural upgrades to non mains connection.
- Reduce phosphorus pathways, for example through blocking field drains and reducing overland runoff routes.

The Diffuse Water Pollution Plan details further measures to address this challenge

2.. Improve riparian habitat

- Convert arable floodplain fields to grassland or wetland
- Expand woodland planting to provide shade and stabilise banks

3. Reduce fine sediment inputs

- Improve soil management to reduce soil runoff from fields
- Increase semi-natural riverside vegetation
- Reconnect the river with its floodplain where possible
- Manage sediment pathways including field drains and the road network

4. Restore natural river processes

- Remove weirs to restore sediment movement and improve fish passage
- Re-naturalise historically over-deepened reaches
- Target restoration where flood risk and infrastructure allow

The River Lugg remains a special and ecologically important river, but it is under significant pressure. With coordinated action across farms, communities, statutory bodies, and land managers, the river can recover. Restoring natural processes, reducing nutrient and sediment pollution, improving riparian habitats, and addressing invasive species will be essential to securing a healthier future for the Lugg.

Introduction

The River Lugg was notified in 1995 as one of the best British mainland examples of both a clay river and a river transitioning from nutrient poor to naturally nutrient rich water chemistry. It was recognised at time of notification that whilst some sections had been channelised, it held high conservation value for its river plant and otter communities. The River Lugg SSSI is composed of four units, the most downstream Unit (1) of the site is also internationally designated as a Special Area of Conservation under the EC Habitats Directive.

The River Lugg is a cross-border river flowing for 101km, with a catchment area of 1077 km^2. The river rises in Powys, Wales near Pool Hill and crosses the English border near Presteigne. The largest conurbation in the catchment is the town of Leominster, which the Lugg flows through around halfway along the English section. The English section flows for 74km in a predominantly south, south-easterly direction joining the River Wye near Mordiford. The Lugg has two major tributaries; the River Arrow joins the Lugg just south of Leominster and the River Frome near the confluence with the Wye at Hampton Meadows.

The Lugg is characterised by both upland and lowland river types and was designated for its transition from a nutrient poor to a naturally nutrient rich river. From Presteigne to Bodenham the river is characterised as ‘Type V’, a sandstone, mudstone and hard limestone river of England and Wales. From Bodenham to Mordiford the river is characterised as ‘Type II’ lowland clay dominated river.

Catchment geology is mixed, the uplands in Wales bring a calcareous influence and are underlain by Silurian mudstones and siltstones, the river is high energy and erosive. As you enter England near Presteigne the geology is predominantly non-calcareous old Red Sandstone of Devonian age with some limestone outcropping. There are bedrock outcrops and alluvial deposits along the riparian floodplain.

From Presteigne to Leominster the river is predominantly natural in character, with well-developed pool and riffle sequences, unstable pebble-gravel bed and fast flows. Significant flood alleviation schemes have been undertaken at Leominster, and the channel is highly modified. Downstream of Leominster the physical modification varies. Significant reaches have been historically dredged and deepened for navigation and agricultural improvement & severe downcutting is evident. Some reaches have started to re-naturalise and display natural erosion and depositional features but remain disconnected from the floodplain. Significant stretches retain a natural planform and physical character.

Land use across the Lugg catchment is dominated by improved grassland and arable agriculture, with some lower intensity sheep pasture in the upper catchment and cattle production in the middle and lower reaches. There are also pig and poultry units, mainly in the Arrow catchment. The river is tree lined along almost the entire length however the floodplain is predominantly utilised for intensive agriculture.

The River Lugg has been designated a Nutrient Neutrality catchment since 2019. This designation is required under the Dutch Nitrogen ruling & aims to protect protected habitat sites which are failing their conservation objectives from further impacts from development activities.

Condition assessments follow the standards set by Joint Nature Conservation Committee (JNCC). Assessment of River condition follow the Common Standards Monitoring Guidance for Rivers (2016) and assess condition against targets set in the sites Monitoring Specification (Natural England 2022).

The assessment of River Habitat requires an investigation into hydrological compliance, water quality, physical habitat structure and biological assemblages. It is a holistic assessment which analyses the natural functioning of the site, in order to determine the sites conservation status.

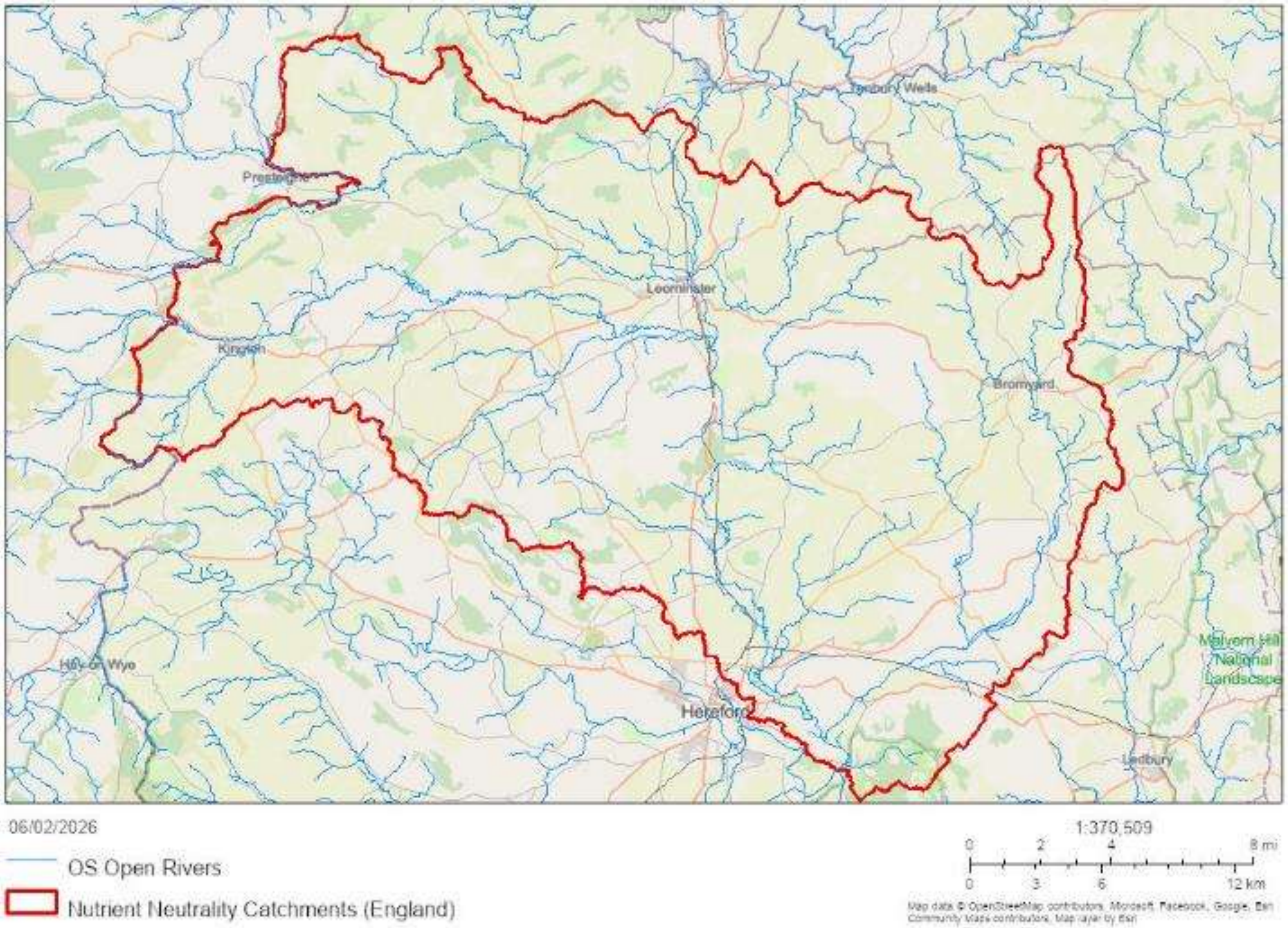
There are six condition categories which can be assigned to the whole site. In order for a site to be considered Favourable, all attributes assessed must pass their target. Natural England's SSSI Monitoring & Reporting Standard, including the definitions of each condition can be found here.

- Favourable
- Unfavourable – Recovering
- Unfavourable – No Change
- Unfavourable – Declining
- Part Destroyed
- Destroyed

The last Common Standards Monitoring (CSM) Condition Assessment of the River Lugg was undertaken in 2010 and recorded the sites as Unfavourable – No Change. In 2013 the site was updated to Unfavourable – Recovering, to reflect the activity underway in the catchment. A partial assessment of site condition was undertaken in 2023 via a desk-based exercise, which assessed a subset of attributes. This assessment recorded the site as Unfavourable – Declining. Further monitoring was required to determine the reasons for the decline, and a full CSM assessment was initiated.

This assessment pulls together data from over four decades, including historic plant surveys & twenty-five years of water quality monitoring. Previous assessments, geomorphological appraisals and historic records have been used to support the assessment to determine site condition & trajectory.

Figure 1. River Lugg Site of Special Scientific Interest Catchment Map



River Habitat Condition Assessment

Flow Compliance

Natural flow regimes underpin the physical and ecological functioning of river systems. The timing, magnitude, and variability of flows shape channel form, transport and sort sediments, and create the mosaic of habitats that aquatic species rely on. Seasonal high flows connect rivers with floodplains, supporting nutrient exchange and spawning cues, while low flows maintain stable refuges for plants and invertebrates. Many organisms have life cycles finely adapted to natural flow patterns, so changes caused by abstraction or land use can disrupt breeding, feeding, and migration. Protecting natural hydrology helps sustain ecosystem resilience, water quality, and the overall health of river environments.

Impermeable bedrock in the upper catchment results in the River Lugg being primarily surface water fed, with flashy flows that respond quickly to rainfall. Field drainage and the removal of vegetation add to this highly responsive nature. While flows subside quickly, in the summer flows are generally low partly as a result of changes to the catchment land use. Winter flows are higher with an increased risk of flooding.

In the middle and lower catchment the geology is more mixed with both permeable and impermeable bedrock. This results in a greater range of hydrological responses across the catchment and drift material can act as shallow aquifers that provide additional flow. The seasonal flooding of the river has resulted in widespread drainage in the lowlands and areas of traditional flood meadow. Artificial flood embankments are a common feature along the SSSI in its lower sections. The River Lugg Internal Drainage Board manage the water levels of Ordinary Watercourses within the District.

Background

JBA Consulting are carrying out flow assessments for Sites of Special Scientific Interest (SSSIs) for Natural England to determine whether flows in the SSSI units confirm to the Common Standards Monitoring Guidance (CSMG) targets. The CSMG guidance, which underpins Natural England’s monitoring of SSSIs, Joint Nature Conservation Committee, 2016 [1], details the allowed flow deviation from natural for rivers depending on their size and range in the flow duration profile.

1 Joint Nature Conservation Committee, 2016, Common Standards Monitoring Guidance for Rivers, 2016.

Study area

The River Lugg is a sub catchment of the River Wye. It rises in mid-Wales, approximately 10 km west of Knighton. The English section comprises of four SSSI units, as shown in Table 1, and in its lower reaches is designated as a Special Area of Conservation (SAC) [2].

Table 1: SSSI reaches in the River Lugg catchment.

SSSI unit	SSSI unit description
Unit 4	Presteigne to Aymestrey
Unit 3	Aymestry to Eyton
Unit 2	Eyton to Hope-under-Dinmore
Unit 1	Hope-under-Dinmore to Wye confluence

The river initially drops steeply, by approximately 480 m, to its mid-point at Leominster, before continuing more gradually to 50 mAOD at the downstream extent. Rainfall follows a similar pattern, with higher average rainfall in the upper reaches, and lower further downstream [3].

Bedrock is dominated by low permeability rocks of the Wenlock and Ludlow Rocks groups which are overlain by glacial till superficial deposits along the river channels and valley floors. There are several large tributaries to the River Lugg, including the River Arrow south of Leominster, and the River Frome near Lugwardine.

Artificial influences are relatively minimal in the catchment, however there are instances of groundwater abstraction for public water supply, and several significant abstractions for trickle irrigation for soft fruit farming. It should be noted that since 2020, abstractions which were previously exempt from requiring a licence to abstract, have required abstraction licences. Most of these new authorisation licences for trickle irrigation now have hands off flows, which should increase flows in the river in periods of drought or prolonged dry weather.

Figure 2. presents the catchment boundary, SSSI units and abstraction points. There are 81 abstraction points with an average daily abstraction greater than 0.1Ml/d however

2 Herefordshire Wildlife Trust (undated) About the Lower Lugg Valley. Available at: https://www.herefordshirewt.org/lowerluggvalley

3 NRFA (undated) 55003 - Lugg at Lugwardine. Available at: https://nrfa.ceh.ac.uk/data/station/spatial/55003

information was provided for a total of 106 licences. SSSI Unit points indicate the downstream extent of each unit. An assessment point within each reach will be used for assessing the temporal flow compliance, with additional points used to carry out longitudinal assessments where there are significant artificial influences or large tributaries, as shown in Table 2.

Figure 2. **Location of the River Lugg SSSI.**

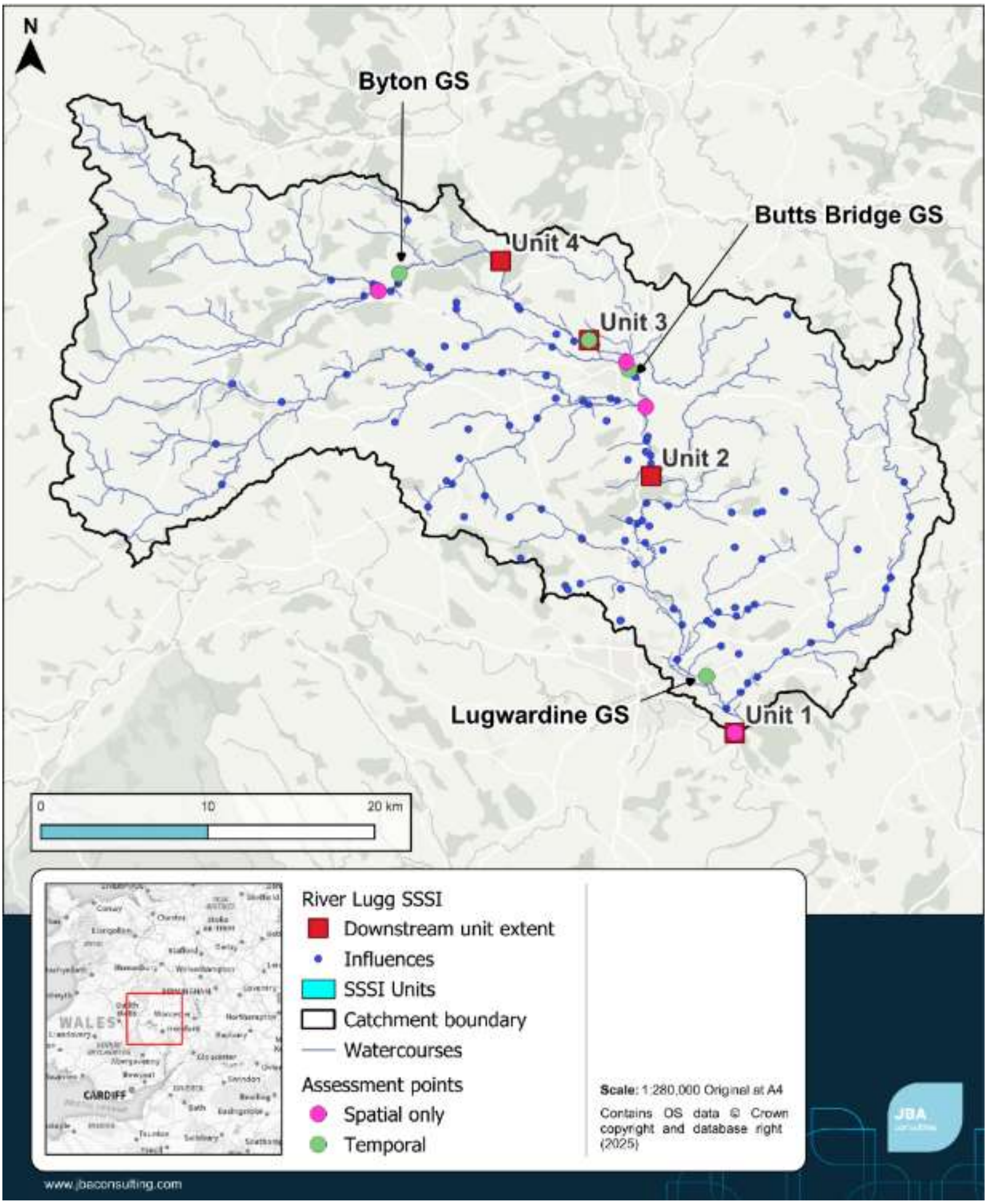


Table 2. Summary of assessment point locations used in the spatial and temporal assessment of the River Lugg SSSI.

SSSI Unit	Assessment point	Location	Easting	Northing	Gauged	Use
Unit 4	Hindwell Brook US	AP4.1	335182	263677	N	Spatial only
	Hindwell Brook DS	AP4.2	335208	263652	N	Spatial only
	Lugg at Byton GS	AP4.0	336464	264698	Y	Both
Unit 3	Eyton	AP3.0	342525	265450	N	Both
Unit 2	Ridgemoor Brook US	AP2.1	350050	259400	N	Spatial only
	Lugg at Butts Bridge GS	AP2	350215	258963	Y	Both
	River Arrow DS	AP2.3	351199	256721	N	Spatial only
Unit 1	Marden	AP1.1	351750	247700	N	Spatial only
	Lugwardine GS	AP1.0	354854	240584	Y	Both
	Wye confluence	AP1.2	356550	237200	N	Spatial only

Data collection and review

Data collection

The River Lugg has three flow gauges at Byton, Butts Bridge and Lugwardine, all of which have gauged data available from the National River Flow Archive (NRFA) until the end of 2024. Table 3 summarises the gauging stations.

Table 3: Gauging stations in the River Lugg catchment.

Station name	SSSI Unit	Station number	Catchment area km2	Station type	Data source
Lugg at Byton	4	55014	203	Flow	NRFA
Lugg at Butts Bridge	2	55021	371	Flow	NRFA
Lugg at Lugwardine	1	55003	886	Flow	NRFA

The Environment Agency and Natural Resources Wales (NRW) have provided naturalised flows until the end of 2020 for the gauging stations on the Lugg at Byton, Butts Bridge and Lugwardine. They have also provided all of the abstraction data with the consumptive factors. Data from NRW has been supplied under licence 29033a, and data from the EA under licence number EIR2025_32981.

In our Freedom of Information data request for assessment of the Wye SSSI previously, we also received the following data for sites in England from the Environment Agency until the end of 2023;

- monthly abstractions
- dry weather flows
- daily discharges where available

The discharge data were not used in our flow naturalisation calculations, as the consumptiveness factors were used instead, to replicate the EA and NRW flow naturalisation methodology.

A list of the abstractions included in the assessment is shown in Appendix A.

Data review

Flow data have been reviewed at a high level, and the abstraction and consumptiveness data have been sense checked. Figure 3 compares the naturalised flows provided by the Environment Agency to calculated naturalised flows based on the influences at Byton gauging station. For the overlapping data period, the flows are very similar with a maximum of +0.2% difference between flows.

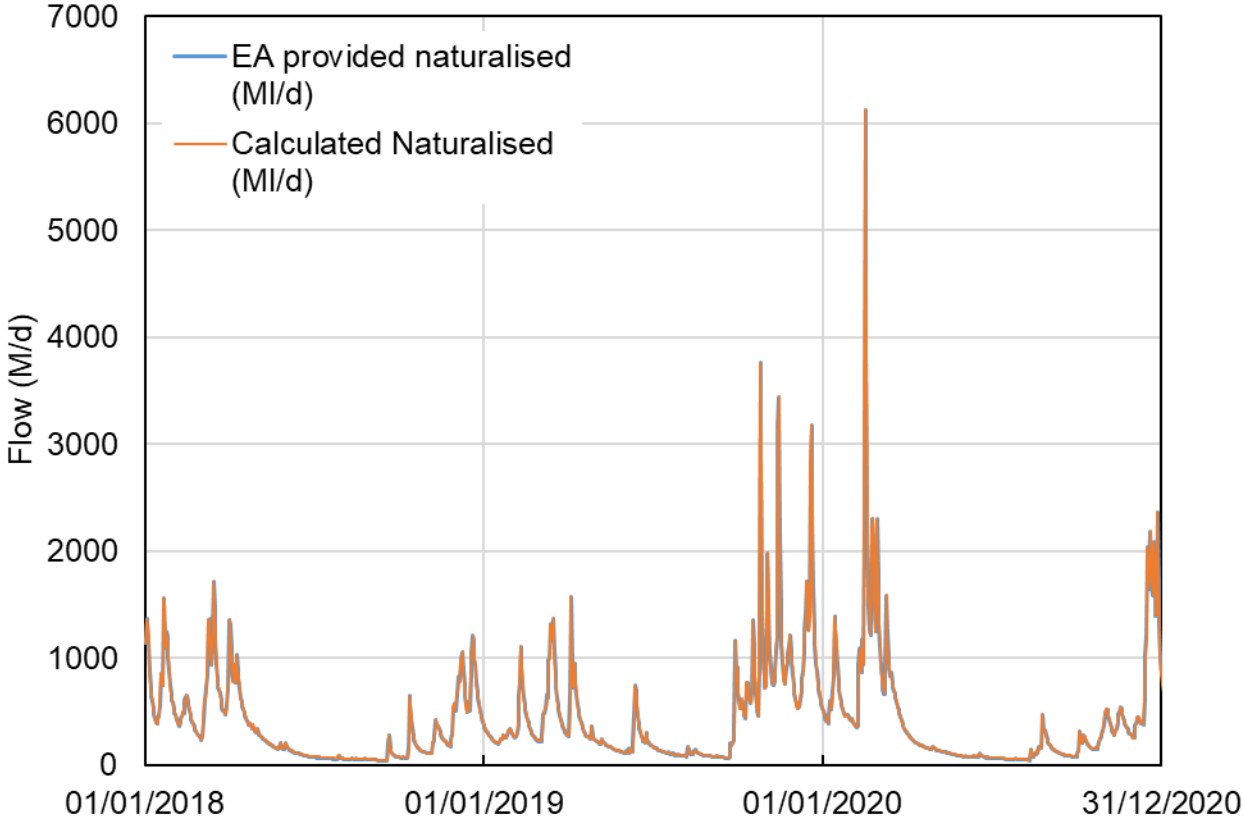


Figure 3. Comparison of calculated naturalised flows, and those provided by the Environment Agency at Byton Gauging Station.

Rainfall and flow data used for the rainfall runoff Probability Distributed Model (PDM) has been quality assessed, and this is described in section 0.

Methodology

Flow targets

Flow targets (Table 4) have been agreed between Natural England and the Environment Agency based on the conservation objectives for rivers within the River Wye Natura 2000 site [4]. These are in place of any targets related to river flows as defined in the CSMG guidance. The targets are consistent across the four SSSI units in the River Lugg catchment.

Table 4: Flow Targets in the River Lugg catchment.

SSSI No.	SSSI Unit	Flow target (%)			
		<Qn95 flow target	Qn50-95 flow target	Qn10-50 flow target	>Qn10 flow target
4	Presteigne to Aymestrey	10	10	15	10
3	Aymestry to Eyton	10	10	15	10
2	Eyton to Hope-under-Dinmore	10	10	15	10
1	Hope-under-Dinmore to Wye confluence	10	10	15	10

Flow naturalisation/de-naturalisation

The EA and NRW provided naturalised river flows for the three gauged locations at Byton, Butts Bridge and Lugwardine, along with abstraction and discharge data. Discharges were represented as consumptiveness factors that are multiplied by the daily abstractions to provide total influences. Naturalised flows have been provided from 1991 - 2020, and abstraction data until the end of 2024. The six assessed years is from 2019 - 2024 inclusive.

The three gauged locations fall within separate SSSI units. Naturalised flows were directly calculated for these units using the gauged flow and influences data, adding the total influences to the gauged flow. Initially, naturalised flow for Unit 3 was modelled using parameters of the probability distributed model (PDM) calibrated to Butts Bridge naturalised flow and scaled based on catchment area (Section 0). Unit 3 gauged flow was calculated by

4 Avon Ecology (2015) River Wye & River Lugg SSSI/SAC flow target Condition Assessment. Avon Ecology for Natural England.

subtracting the abstractions and consumptiveness factors from the modelled naturalised flow. The same method can be used for other ungauged locations.

PDM modelling

PDM modelling background

The PDM is a conceptual rainfall-runoff model used to simulate the transformation of rainfall and evaporation into runoff at a defined catchment outlet [5]. In this project, PDM has been used at assessment points to derive flow - for more information refer forward to Section 0.

PDM assumes that the spatial variation in soil storage capacity across the catchment is represented by a probability distribution and can be defined by a series of parameters controlling the shape and scale of storage and routing.

PDM model inputs include rainfall and evaporation time series. Key assumptions of the inputs include constant net rainfall during rainfall intervals, and spatial uniformity of the rainfall over the soil moisture store.

Calibration aims to ensure the model accurately represents the catchment hydrological response under varying rainfall conditions. Model parameters are adjusted to achieve a best fit with observed streamflow data.

Model approach and calibration

A PDM was developed/ calibrated at Butts Bridge gauging station using the naturalised flow provided by the EA. Calibration focussed particularly on accurately representing flows over the period from 2010 - 2020 in line with the data availability. The naturalised flow series were quality assessed, with periods of zero data or erroneous spikes removed from the calibration dataset. Butts Bridge is the closest gauge to the ungauged Unit 3. The modelled naturalised PDM flow was therefore scaled based on catchment area to derive a naturalised flow for Unit 3.

An inconsistent longitudinal profile would result from the use of two or three separate PDM locations being applied along ungauged locations. This is due to limitations within the conceptual modelling in different locations that the PDM is based on, therefore introducing uncertainties from difference parameter inputs.

PDM inputs

Rainfall inputs were derived initially from Thiessen Polygon analysis, whereby weightings of nearest rain gauges to the catchment were applied. Rain gauge series were first assessed for their quality and either erroneous values removed, or discounting of the gauge from use in the PDM if necessary. Weightings were simplified to include gauges within, or closest to

[5] Moore (2007) The PDM rainfall-runoff model. Hydrology & Earth System Sciences, 11(1).

the catchment whilst maintaining spatial coverage. Individual weightings were applied to each rain gauge to produce a catchment average rainfall input.

A standard sine curve profile was applied to represent potential evaporation input, applying a minimum evaporation of 0mm/day and a maximum of 3.1mm/day. The peak evaporation was set to occur in August each day.

PDM Model Performance

Butts Bridge PDM Performance

Figure 4 presents the simulated PDM and observed naturalised flows at Butts Bridge. Calibration focussed on representing flows over the period from 2010 to 2020. Validation was carried out against observed flows over a longer period of time, however this was dependent on the length of flow and rain data available. Overall, the performance of the simulated flow is good, with a Nash-Sutcliffe Efficiency (NSE) 'goodness of fit' score of 0.84 for the calibration period. A score of 1 indicates a perfect fit, and scores above 0.75 indicate a good fit. The PDM model does however underestimate some of peaks, and at times overestimates lower flows. In general, the PDM modelled flows are sufficiently accurate to assess a 10% deviation from natural flows, but at times when the PDM model appears to underestimate the lowest flows, the deviations from natural flows are smaller than the model error. Figure 5 compares the scaled naturalised flows from the PDM model to the naturalised flows calculated from scaled gauged flow. The PDM scaled flow underestimates periods of low flow which is not representative of the true low flows. This is due to the PDM model parameters allowing greater losses than occurs so is a result of the model uncertainty rather than any physical processes. Sensitivity analyses have shown that this can impact the flow compliance results at low flows, and so scaling of gauged flows has been tested as an alternative and is used for flow compliance assessment. The lower plot in Figure 5 uses a logarithmic scale and highlights the underestimation of low flows.

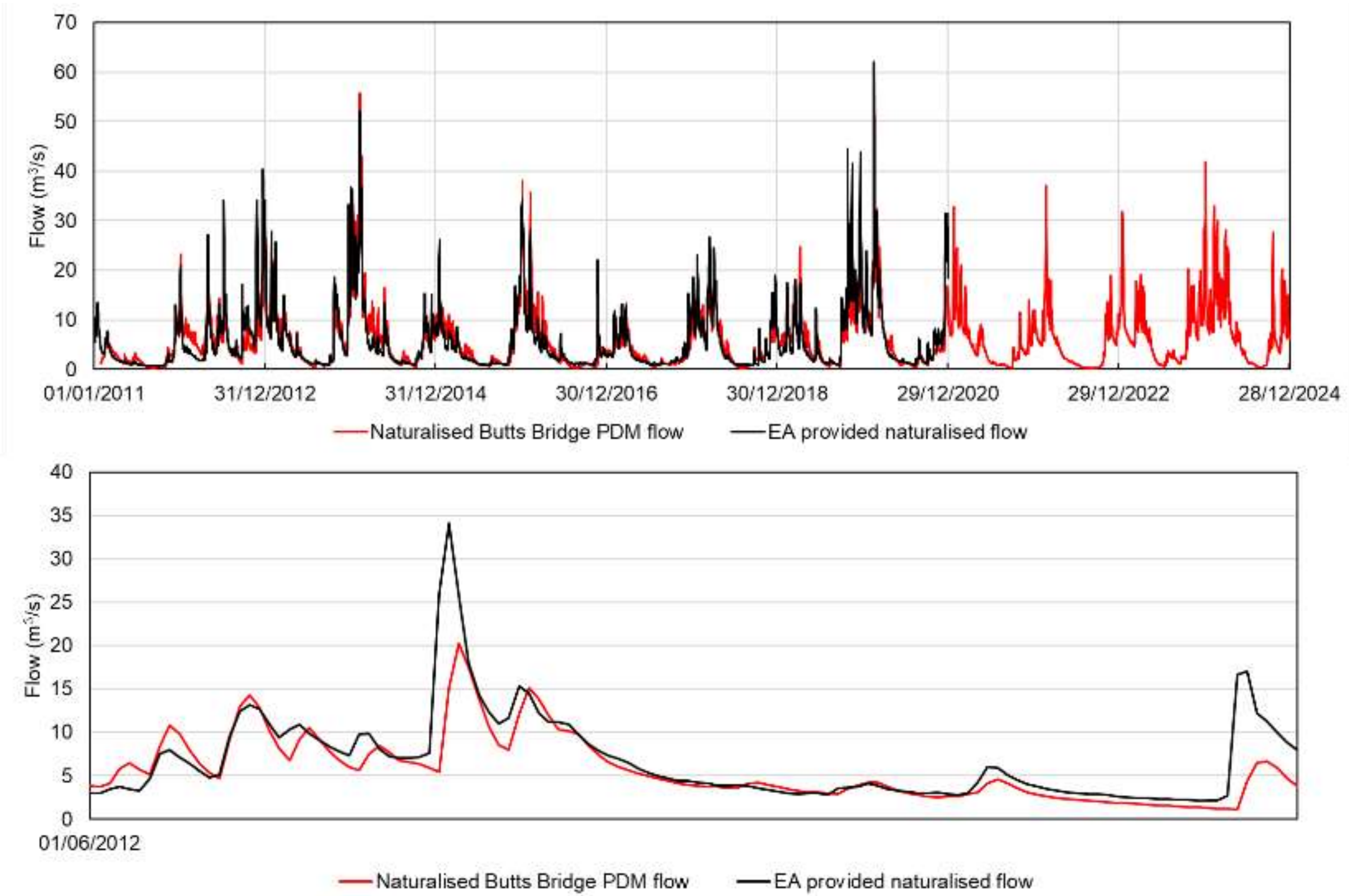


Figure 4. Naturalised Butts Bridge PDM flows (red) compared against EA provided naturalised flows (black).

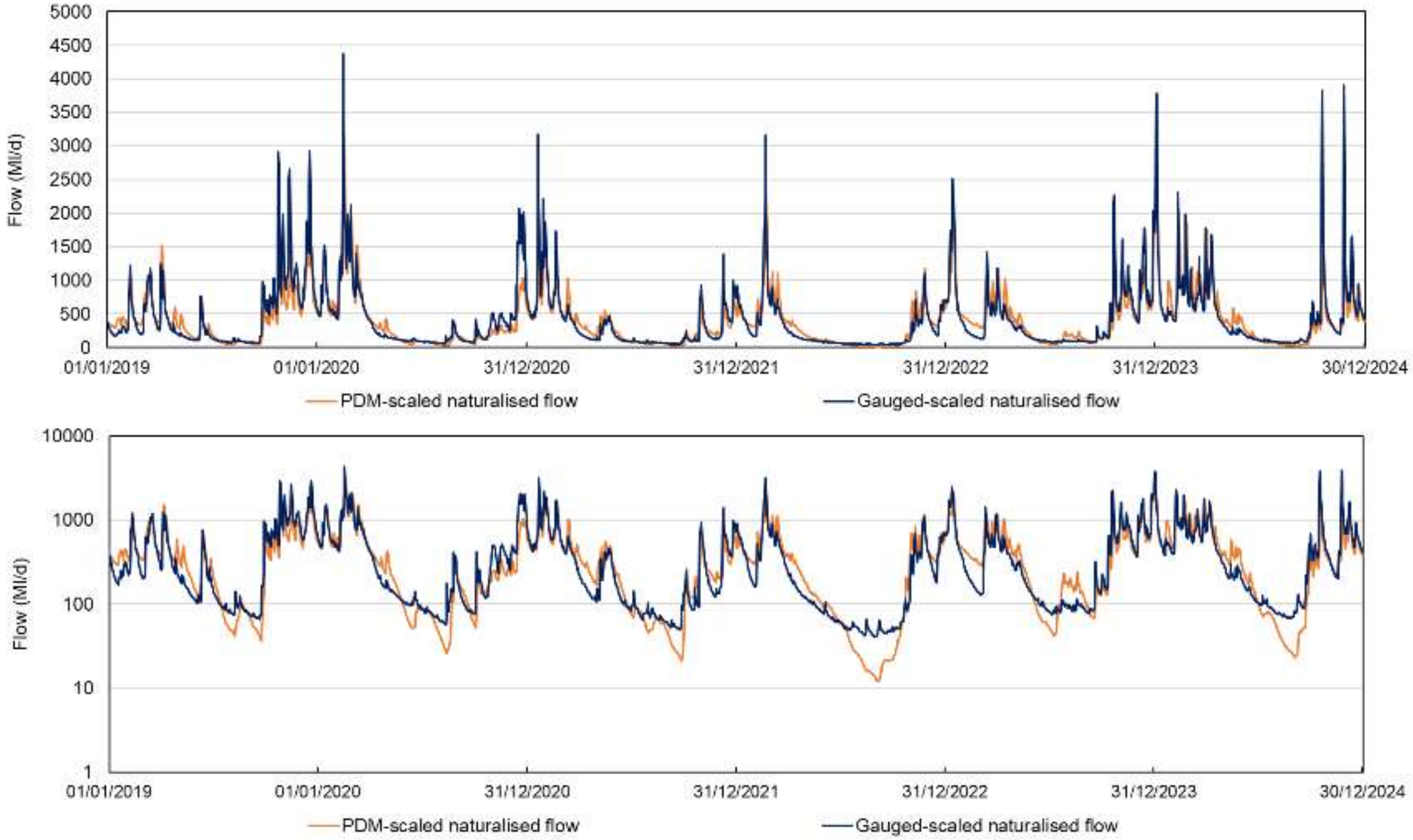


Figure 5. Naturalised flows for SSSI Unit 3 (assessed at Eyton). PDM-scaled naturalised flows are scaled from the calibrated naturalised PDM at Butts Bridge. Gauge-scaled naturalised flows are scaled from the naturalised gauged flow at Butts Bridge.

Flow compliance results

Temporal Flow Compliance

The following pages present flow compliance for each assessment point between 2019 - 2024. The percentage deviation from the naturalised flow is shown above the time series of modelled naturalised and artificially influenced flows. The percentage deviations are shown up to 20%. For unit 1, 2 and 4, compliance is assessed at the respective gauging station, whilst unit 3 is assessed at the downstream end of the unit at Eyton.

Initial analyses using the PDM modelled flows for unit 3 showed that the flow compliance at unit 3 showed failures due to the low values of the PDM modelled at low flows, which were far lower than the naturalised flows for the Butts Bridge gauge (and other gauges tested). Therefore, the Butts Bridge naturalised flow, calculated from the gauged flow, has been scaled by catchment area to obtain naturalised flows for unit 3.

Temporal flow compliance graphs

River Lugg SSSI Unit 4 - Presteigne to Aymestrey.

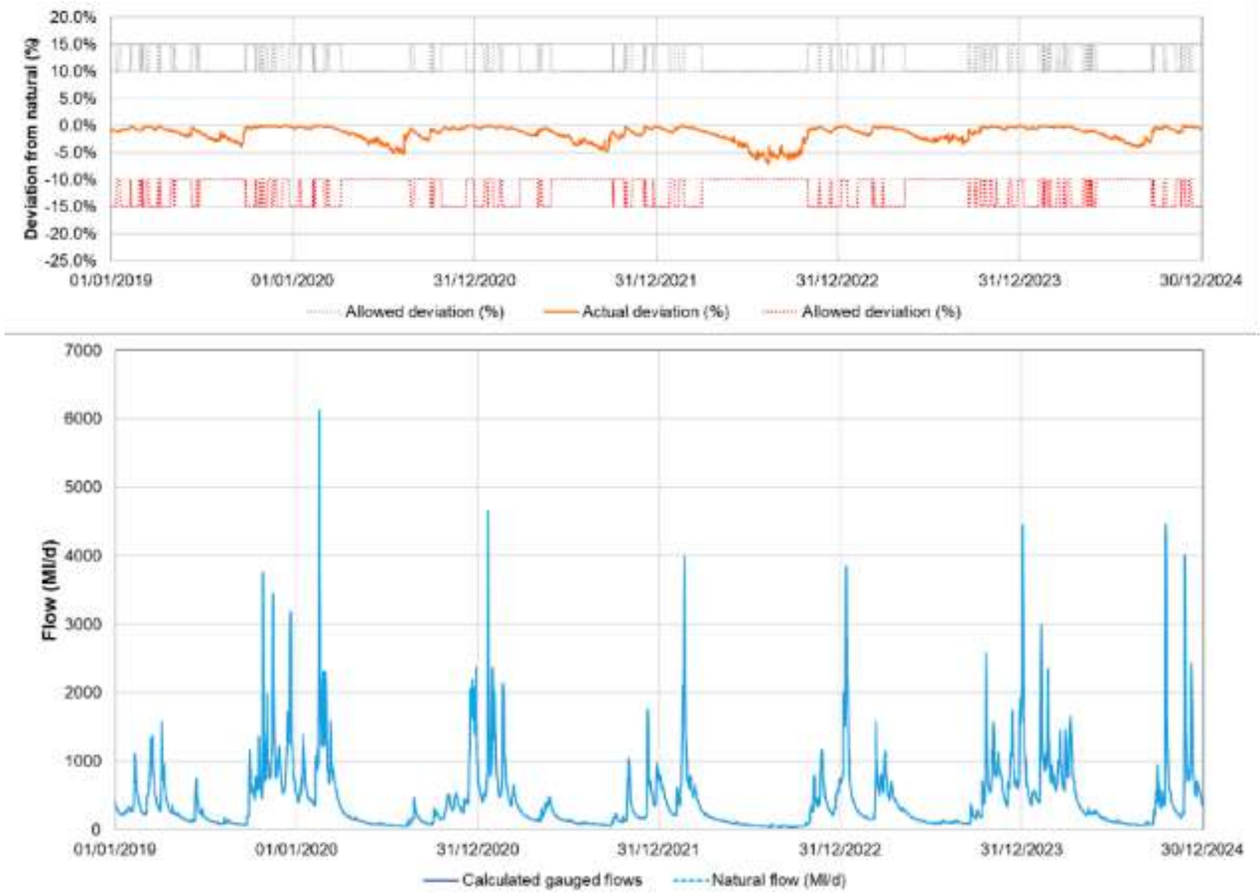


Figure 6. Time series plot of the River Lugg Unit 4.

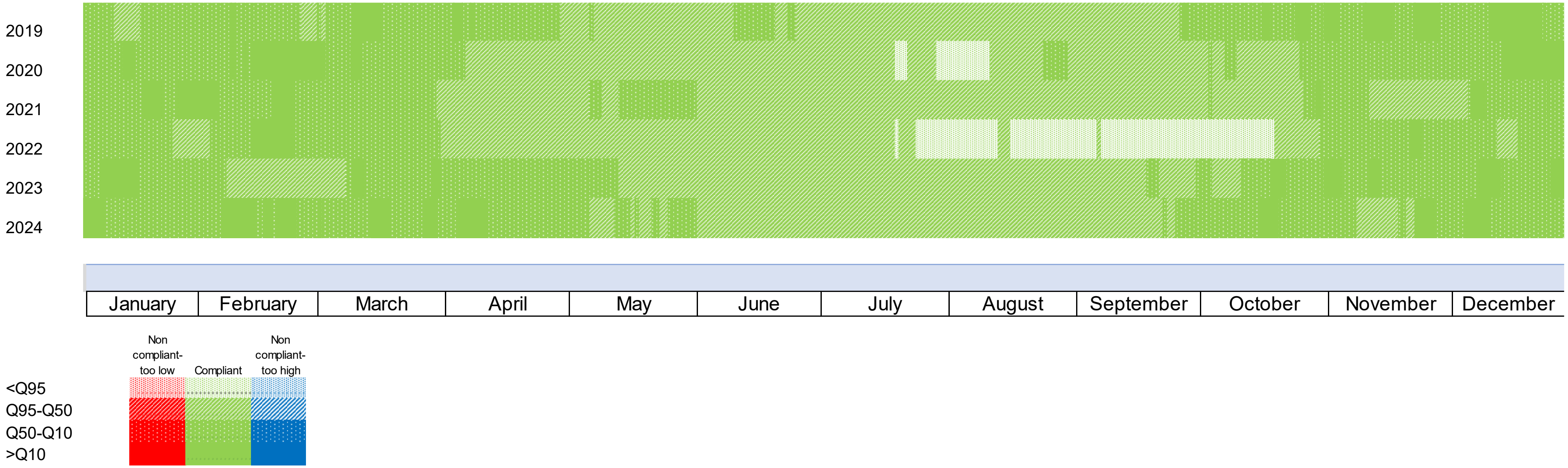


Figure 7. Compliance of the River Lugg Unit 4.

River Lugg SSSI Unit 3 - Aymestrey to Eyton.

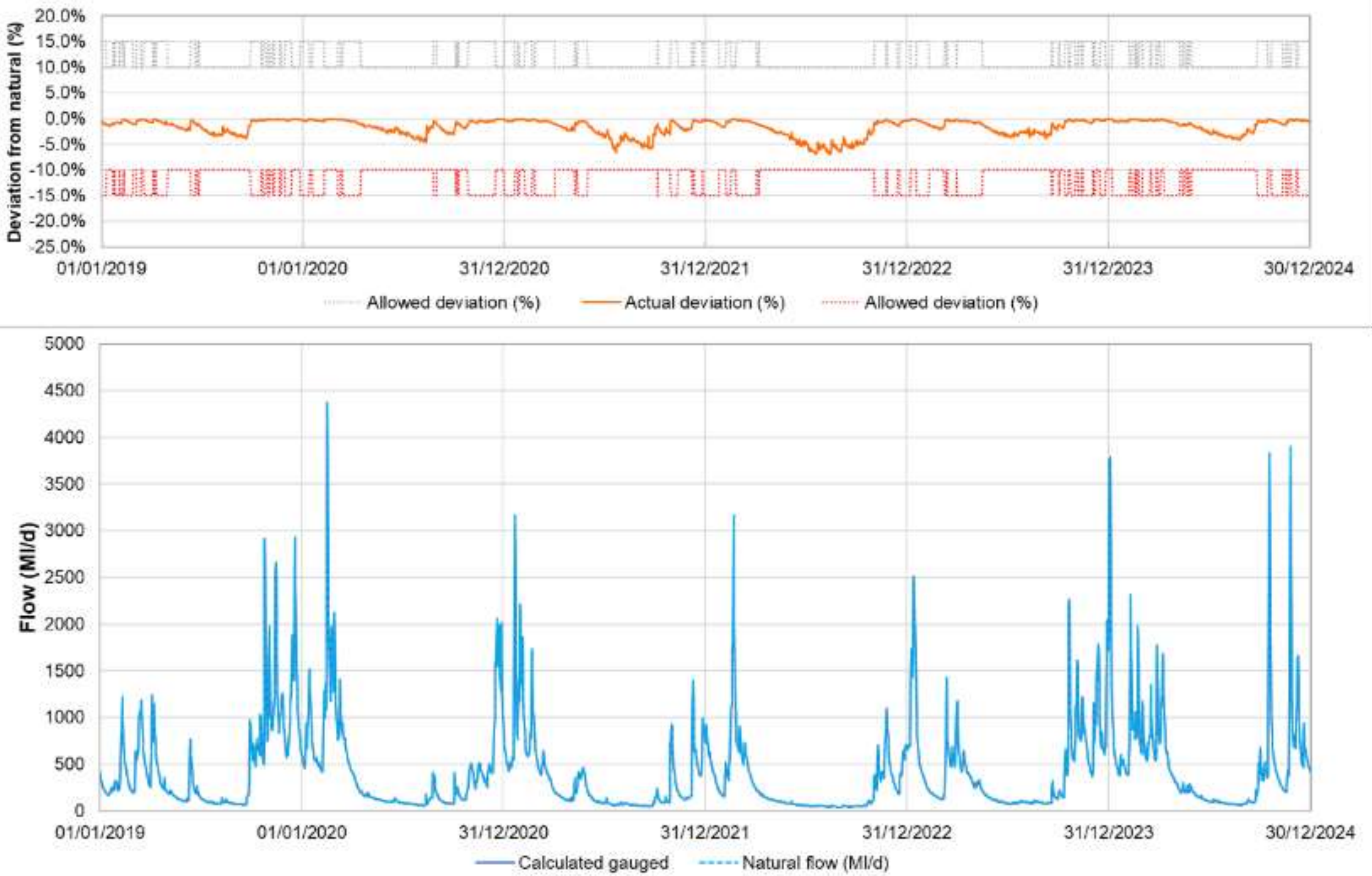


Figure 8.Time series plot of the River Lugg Unit 3.

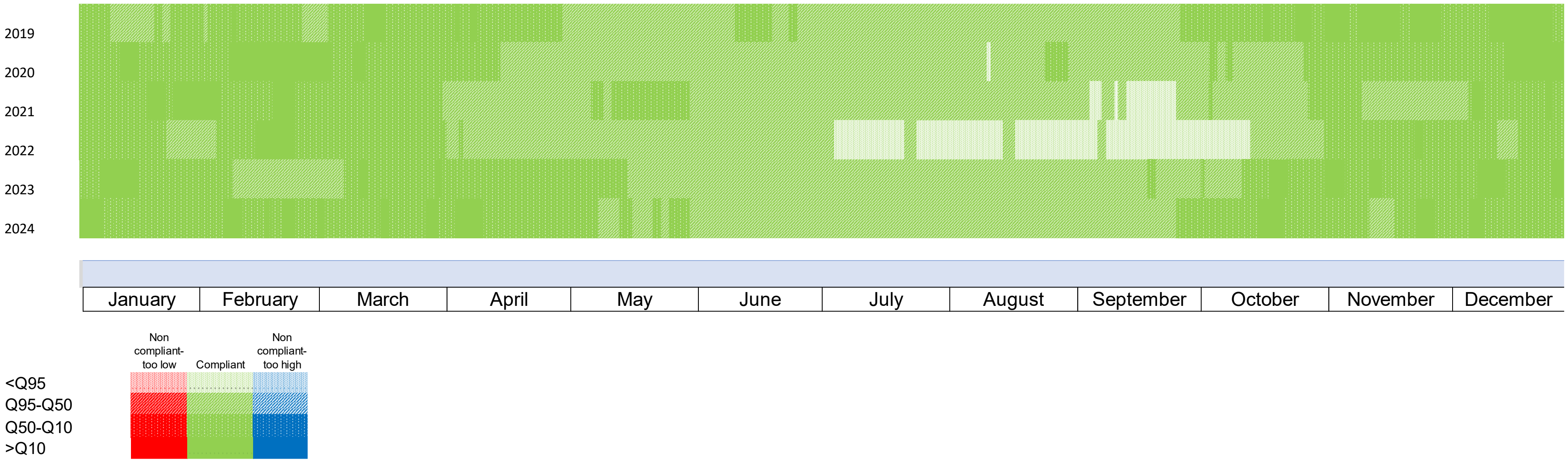
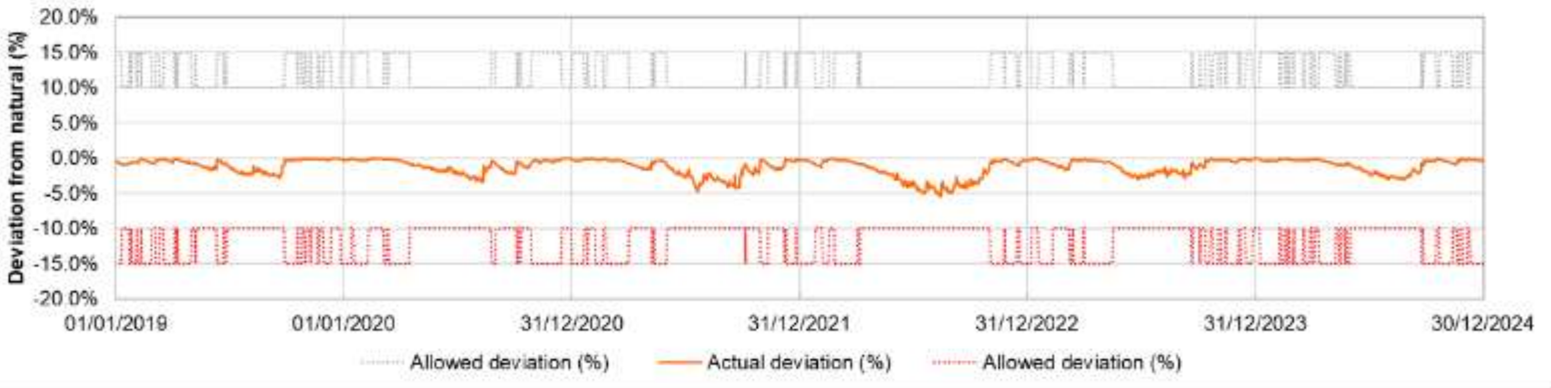


Figure 9. Compliance of the River Lugg Unit 3.

River Lugg SSSI Unit 2 - Eyton to Hope-under-Dinmore.



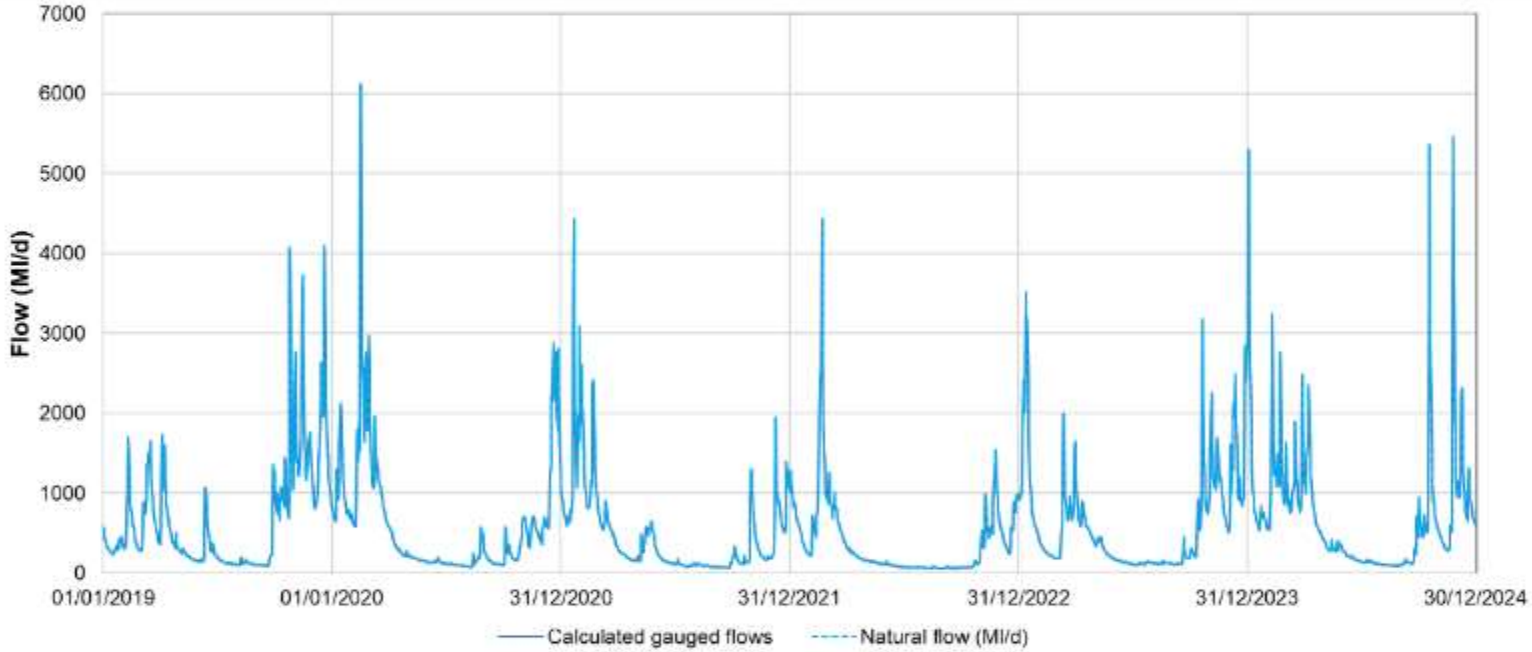


Figure 10. Time series plot of the River Lugg Unit 2.

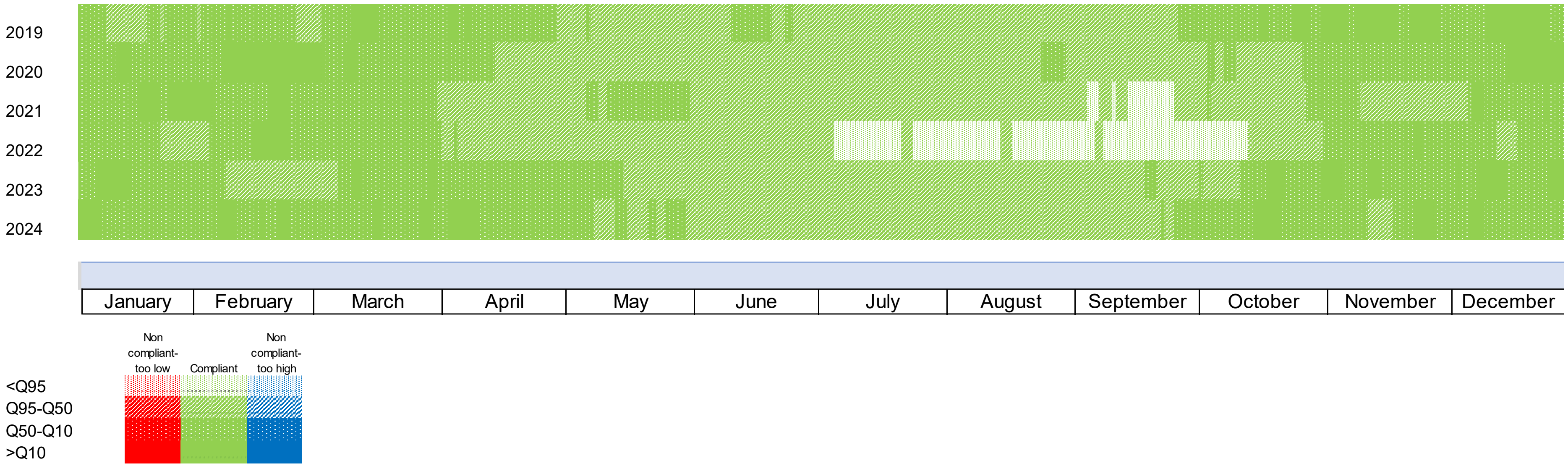


Figure 11. Compliance of the River Lugg Unit 2.

River Lugg SSSI Unit 1 - Hope-under-Dinmore to River Wye confluence.

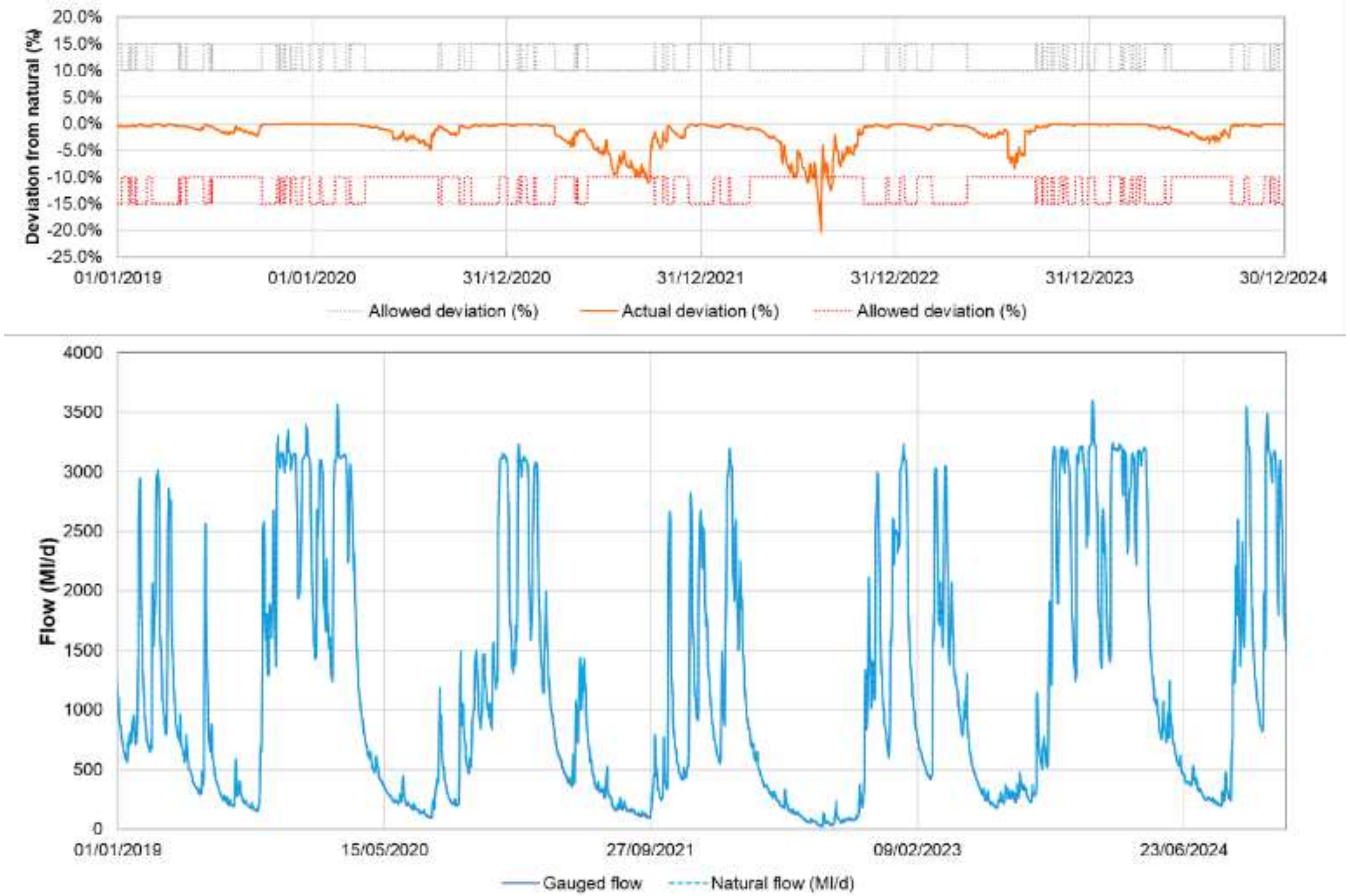


Figure 12. Time series plot of the River Lugg Unit 1.

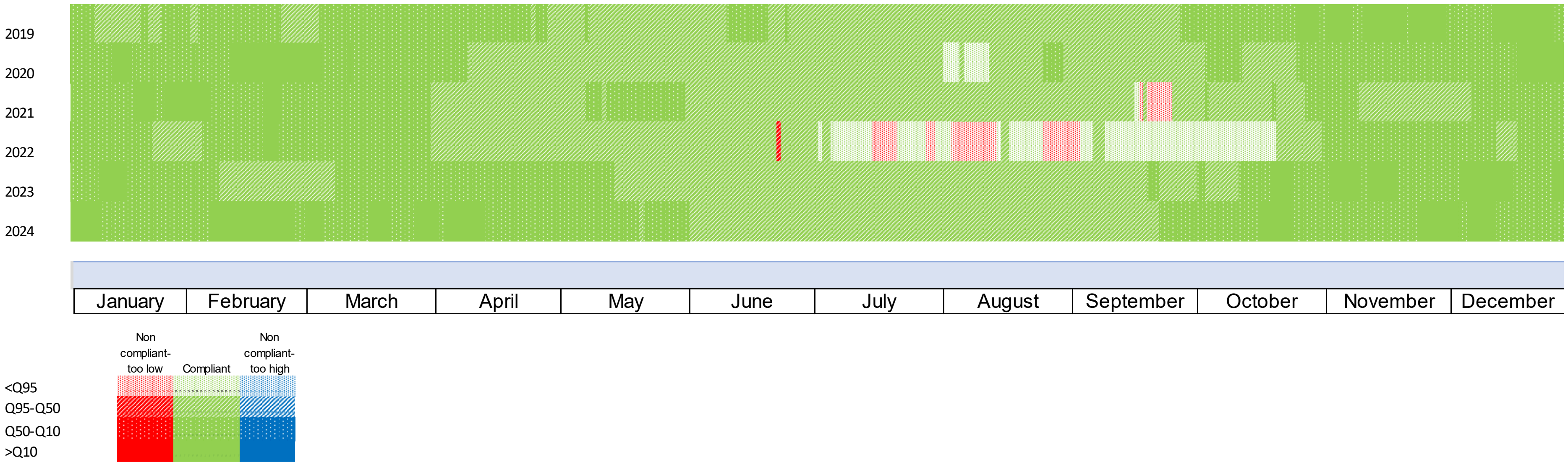


Figure 13. Compliance of the River Lugg Unit 1.

Summary of temporal flow compliance

Summary statistics of all periods of non-compliance exceeding 10 consecutive days, based in maximum percentage deviation, are presented in Table 5. Units 4, 3 and 2 are compliant over all flow percentiles, with no failures observed between 2019 - 2024. Periods of failure are observed in Unit 1 in 2021 and 2022 due to flow being too low in the <Q95 - flow range, however only one of these exceeds 10 consecutive days. The maximum length of these failures is 11 days. Guidance states that 10-days of continuous non-compliance in any one year, or 20-days of non-compliance overall in any one year is considered the maximum acceptable limit [6].

Table 5. Top three ranked periods of failure, as defined by maximum percentage deviation, for each SSSI Unit.

Start date of non-compliance	End date of non-compliance	Number of days	Average naturalised flow during non-compliance (Ml/d)	Max naturalised flow during non-compliance (Ml/d)	Max % deviation from naturalised during non-compliance (Ml/d)
Unit 4 - Presteigne to Aymestrey					
No failure periods exceeding 10 consecutive days.					
Unit 3 - Aymestry to Eyton					
No failure periods exceeding 10 consecutive days.					
Unit 2 - Eyton to Hope-under-Dinmore					
No failure periods exceeding 10 consecutive days.					
Unit 1 - Hope-under-Dinmore to Wye confluence					
05/08/2022	15/08/2022	11	37.2	45.8	-11%

6 JNCC (2016) Common Standards Monitoring Guidance for Rivers. Joint Nature Conservation Committee.

Spatial Flow Compliance

Naturalised flows for spatial flow compliance have been calculated by scaling the Butts Bridge naturalised flow by catchment area to obtain naturalised flows at the required locations, and gauged flows have been calculated by subtracting the influence data at each location.

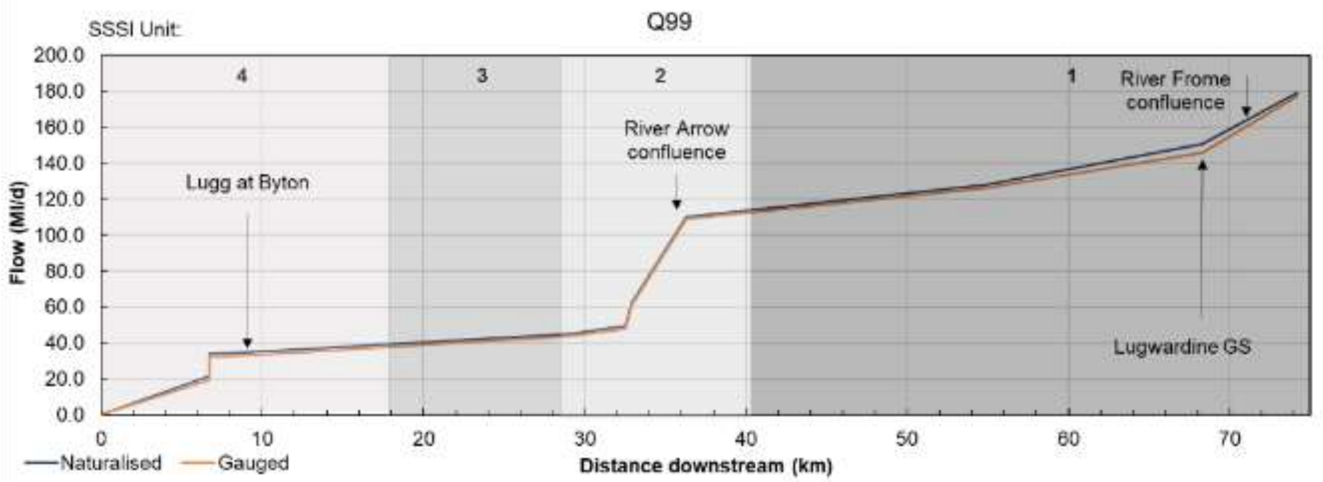


Figure 14 to Figure 19 compares the gauged and naturalised flow percentiles (Ml/d) at ten locations along the River Lugg from the most upstream SSSI unit to the confluence with the River Wye. Each longitudinal profile presents the SSSI units and other key locations such as tributaries. It should be noted that this does not necessarily represent naturalised and gauged flows at the same time, but when each respective flow exceeds a certain flow threshold.

The greatest percentage deviation between naturalised and gauged flow is observed at the Q99 threshold at the upstream extent of the SSSI. Naturalised and gauged flows are largely similar in terms of percentage difference in flow percentiles Q95 to Q10.

The absolute difference (total difference in Ml/d) is greatest in Unit 4 of the Q50 flow percentile. As flows are proportionately bigger at this flow percentile, the percentage difference is however smaller than seen at the Q99 threshold. Across all percentiles, the absolute difference increases with distance downstream along the course of the River Lugg.

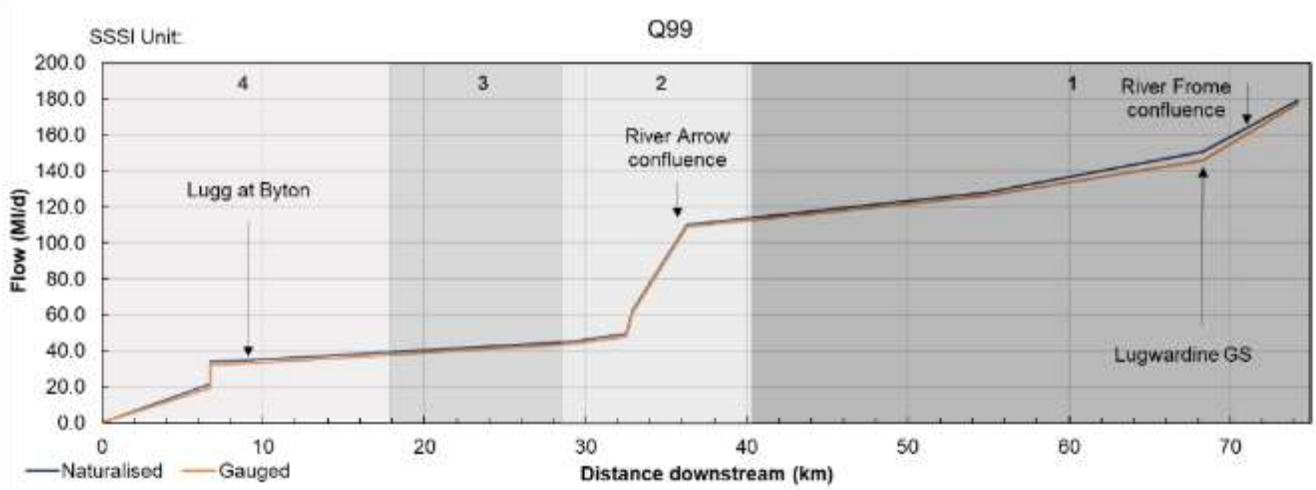


Figure 14: River Lugg longitudinal profile at the Q99 flow percentile.

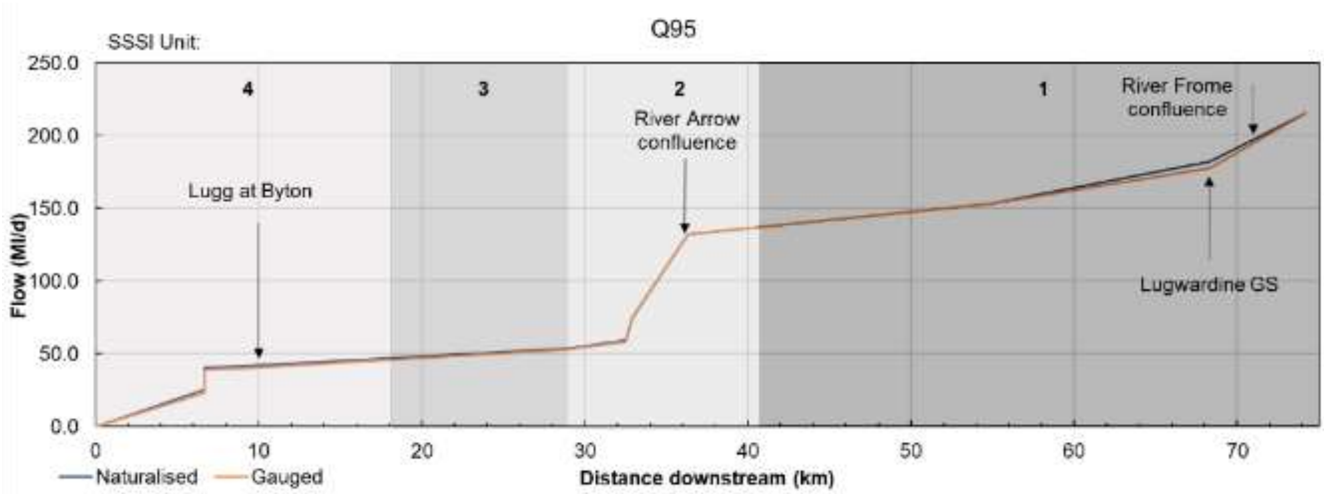


Figure 15. River Lugg longitudinal profile at the Q95 flow percentile.

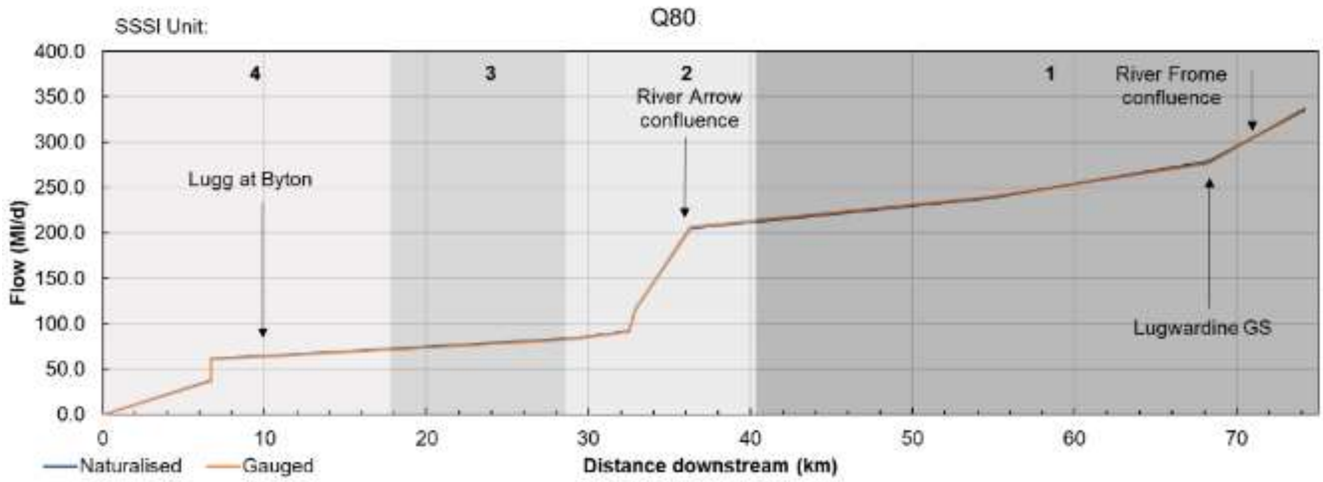


Figure 16. River Lugg longitudinal profile at the Q80 flow percentile.

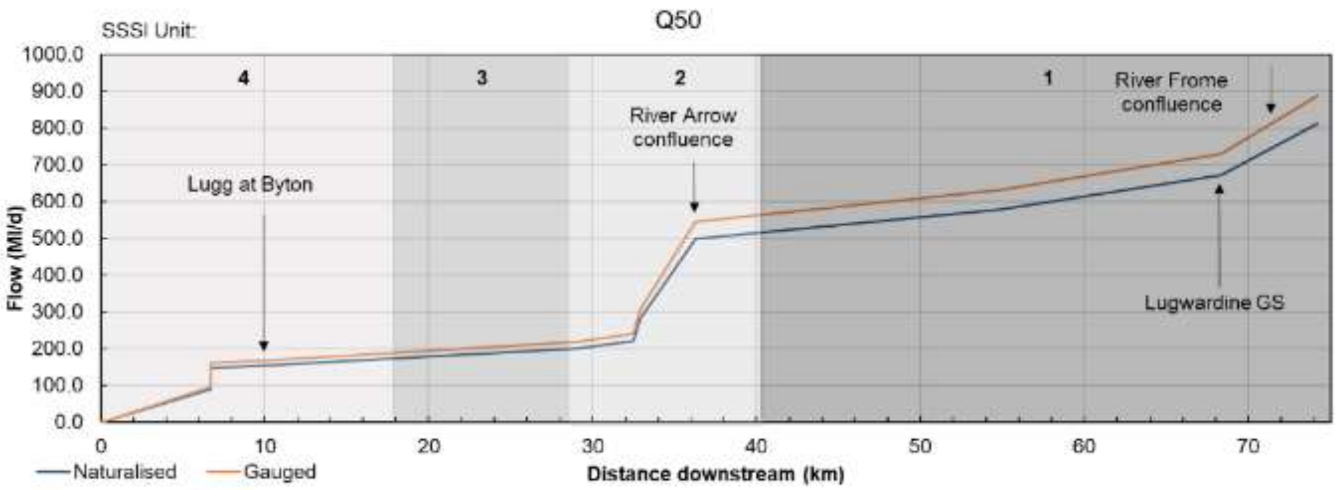


Figure 17. River Lugg longitudinal profile at the Q50 flow percentile.

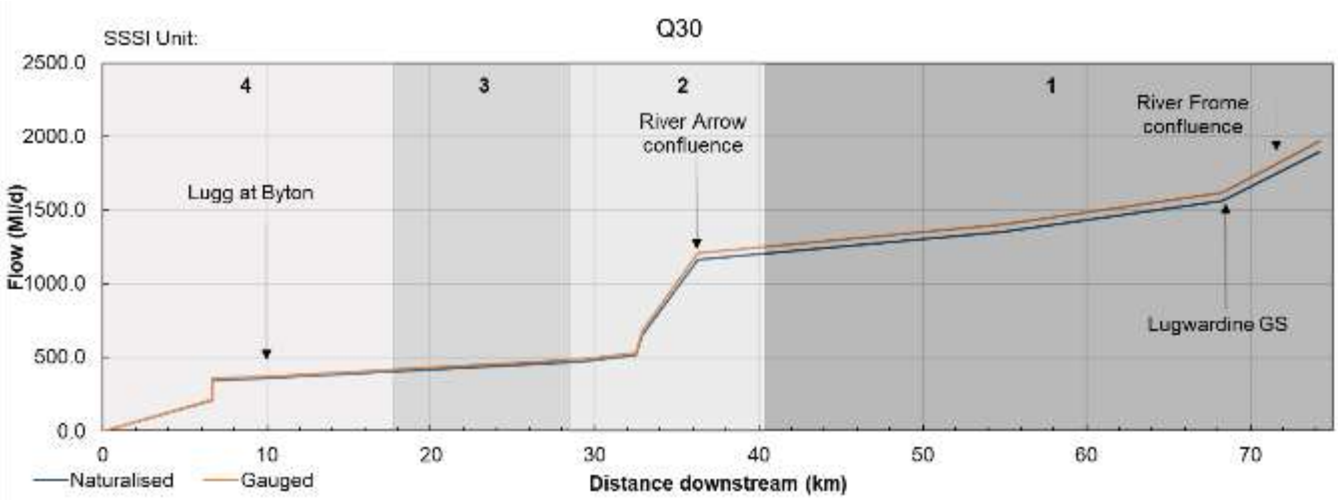


Figure 18. River Lugg longitudinal profile at the Q30 flow percentile.

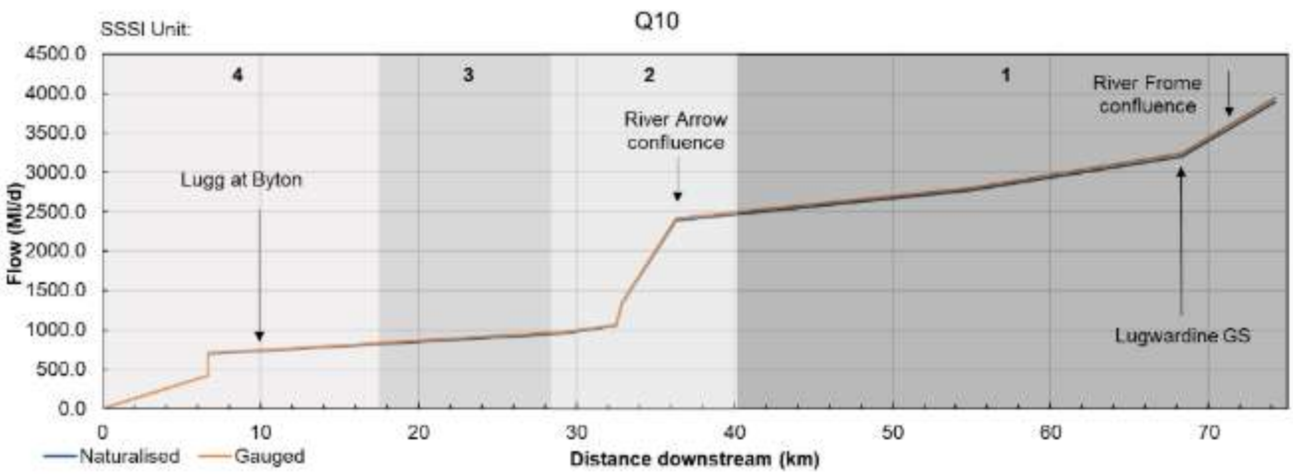


Figure 19. River Lugg longitudinal profile at the Q10 flow percentile.

Summary of flow compliance

Table 6 summarises the spatial flow compliance. At Q10 - Q95, the River Lugg is compliant across all locations. At the Q99 flow percentile, there is a failure at the uppermost assessment point upstream of the Hindwell Brook confluence, and this is only by a small amount (target range of no more than 10% below naturalised flow, and actual deviation of 11%).

Table 6: Spatial flow compliance targets and summary for the River Lugg SSSI.

Distance downstream /km	6.7	6.7	10.0	29.1	32.5	32.9	36.3	54.9	68.3	74.2
SSSI unit	4	4	4	3	2	2	2	1	1	1
	Target deviations									
Q99	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Q95	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Q80	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Q50	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Q30	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Q10	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
	% deviation from natural									
Q99	-11%	-6%	-5%	-4%	-3%	-2%	-1%	-1%	-3%	-1%
Q95	-8%	-4%	-4%	-1%	-2%	-1%	0%	0%	-3%	0%
Q80	-4%	-2%	-2%	-1%	-1%	0%	1%	0%	-1%	1%
Q50	7%	8%	8%	9%	9%	9%	9%	9%	9%	9%
Q30	3%	3%	3%	3%	3%	4%	4%	4%	4%	4%
Q10	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Key	Compliant									
	Non compliant- flows above target									
	Non compliant flows below target									

Table 7: Temporal flow compliance targets and summary for the River Lugg SSSI.

SSSI no.	SSSI Unit	Compliance status	Flow used for assessment
4	Presteigne to Aymestrey	Compliant	Byton GS
3	Aymestry to Eyton	Compliant	Butts Bridge GS scaled to Eyton
2	Eyton to Hope-under-Dinmore	Compliant	Butts Bridge GS
1	Hope-under-Dinmore to Wye confluence	Non Compliant - flow too low	Lugwardine GS
Compliant			
Non-compliant - flow too high			
Non-compliant - flow too low			

Conclusions

Flow assessments have been carried out for the most recent six years of available data, from 2019 - 2024 inclusive. Gauged flows have been used where available for the assessments, with naturalisation undertaken using the abstraction and discharges, as represented by the consumptiveness factors. Flows scaled by catchment area were used at ungauged locations. Flows on the Lugg are generally close to natural, and where flow failures have occurred, they are of short duration, and by small amounts.

Spatial Compliance

Flow percentiles Q10 - Q95 are compliant along the whole course of the River Lugg. In these flow bands the largest deviation from natural above the target is 9% and the largest deviation below the target is -8%, therefore within the 15% and 10% flow targets. At the lowest flows (Q99) there are non-compliant flows due to gauged flows being below the target at the uppermost assessment point at the confluence with Hindwell Brook. The greatest deviation is -11%, seen at for the Q99 percentile, compared to the 10% deviation of flow target, so the failure is by a small amount but does suggest that Unit 4 may be susceptible to periods of low flow in the summer months

Temporal Compliance

Unit 1 shows failures in the CSMG targets at low flows due to flow being below the target when compared to the naturalised flow. Units 4, 3 and 2 are compliant across all flow percentiles, with no failure periods exceeding 10 consecutive days.

Discussion and Limitations

Discussion of results

The temporal failure occurred in summer 2022 in Unit 1. This was the fourth driest year in the 131-year record in the Lower Wye catchment. There was below average rainfall, combined with high temperatures, therefore increasing abstraction demand. With lower-than-average river flows, in addition to greater abstractions, the abstractions made up a greater proportion of flow, increasing the risk of failure.

Spatial compliance failures occur at Q99, at the upstream reach of Unit 4. The largest abstractions in this unit are 19/55/8/0193 and 19/55/8/0179 with average daily abstractions of 8333 and 2386 Ml/d respectively. These abstractions are licenced for spray irrigation and potable water supply. At this point flows are very small (<40 Ml/d), therefore it does not require large abstractions to influence flow by greater than 10%. It should also be noted that the failure at this location is 11%, only 1% greater than the target compliance, therefore the magnitude of failure is small.

The New Authorisations Licences do not appear to have had a significant impact on flow compliance, partially because flows were compliant before their introduction during 2020, and partly because the lowest flows have occurred in 2022, since their introduction. It is possible that without the Hands off Flows associated with the licences, the periods of low flow would not have been compliant in 2022, but these analyses do not provide this information.

Sensitivity to flow targets

The information provided by Natural England at the start of the wider SSSI flow assessment project suggested the River Lugg SSSI having a >Q10 flow target of 15%, as opposed to 10% as used in this assessment (Table 4). No flow deviations for flows greater than Q10 were larger than 10%, so this discrepancy in flow target does not impact the conclusions of either the spatial or temporal analysis.

Limitations

- Naturalised flow data is derived from abstraction records, which may include approximations or assumptions, particularly for smaller influences. Much of the abstraction data for England has been provided at a monthly timestep, and apportioned equally throughout the month, which will give inaccurate results, especially at low flows.
- Discharges are represented by consumptiveness factors on the abstractions which is uncertain as the true consumptiveness factor varies depending on weather and other factors. Assuming a constant factor per licence oversimplifies a complex and artificially changing variable. It also fails to consider the discharge location, which is unlikely to be at the abstraction point, as so does not account for any denuded reaches of the river.
- Simple scaling of naturalised flows (derived from gauged flows) by catchment area has been used to estimate flows at ungauged locations. There are uncertainties using this method, but, but this has been used in preference to the PDM modelled flows due to the discrepancies between gauged and modelled flows at low flows. While reasonable for approximations, this simple scaling method may not capture localised hydrological variability.
- The chosen six-year period may not encompass sufficient hydrological variability, such as extreme droughts or floods, to fully evaluate flow compliance across different conditions. However, it is noted to include the 2022 drought period which was the fourth driest year in the 131-year record.

Water Quality

Monitoring water quality is fundamental for assessing the health of river habitats. It allows detection of pollution and enables an understanding of whether the pollution is posing a risk to the ecological health of the river. The assessment of water quality is split into an assessment of organic pollution and nutrients (orthophosphate).

Eutrophication occurs in rivers when there is an excess of nutrients in the system. Eutrophication can cause changes in species composition & result in a dominance by phytoplankton, algal blooms, oxygen sags and at the extreme fish kills.

Excessive nutrients are one of the greatest pressures on our freshwater environments and have significant detrimental impacts on the healthy and resilient functioning of the system. Once eutrophication impacts have occurred, they are difficult to reverse and require catchment scale solutions to mitigate the impact.

Orthophosphate, or reactive phosphorus, is the determinant used to assess nutrient pressure in rivers. Levels of orthophosphate in rivers are particularly important as it is naturally a scarce nutrient that limits excess productivity. As such, most rivers are described as phosphate limited.

Approach

Openly available water quality sets data were downloaded from the Environment Agency's (EA's) Water Quality Archive covering the period 2000-2025.

Table 8 presents the available data sets on the River Lugg SSSI, used to undertake the condition assessment. There are eleven ten water quality monitoring sampling points which have data collected within the last 3 years. The assessment period was selected based on the best available data, considering the number and spread of samples.

The water quality assessment period varied between monitoring locations according to data availability, with most sites assessed using data from 2023–2025 and a small number of sites assessed using data from 2021–2023. Monitoring coverage was generally sufficient to assess nutrient enrichment, ammonia and dissolved oxygen attributes across the River Lugg SSSI. Coverage was lower at several upstream sites, particularly Rossers Bridge and Hindwell Brook. Biological Oxygen Demand data were sparse or absent at most locations and results for this attribute should therefore be interpreted with caution.

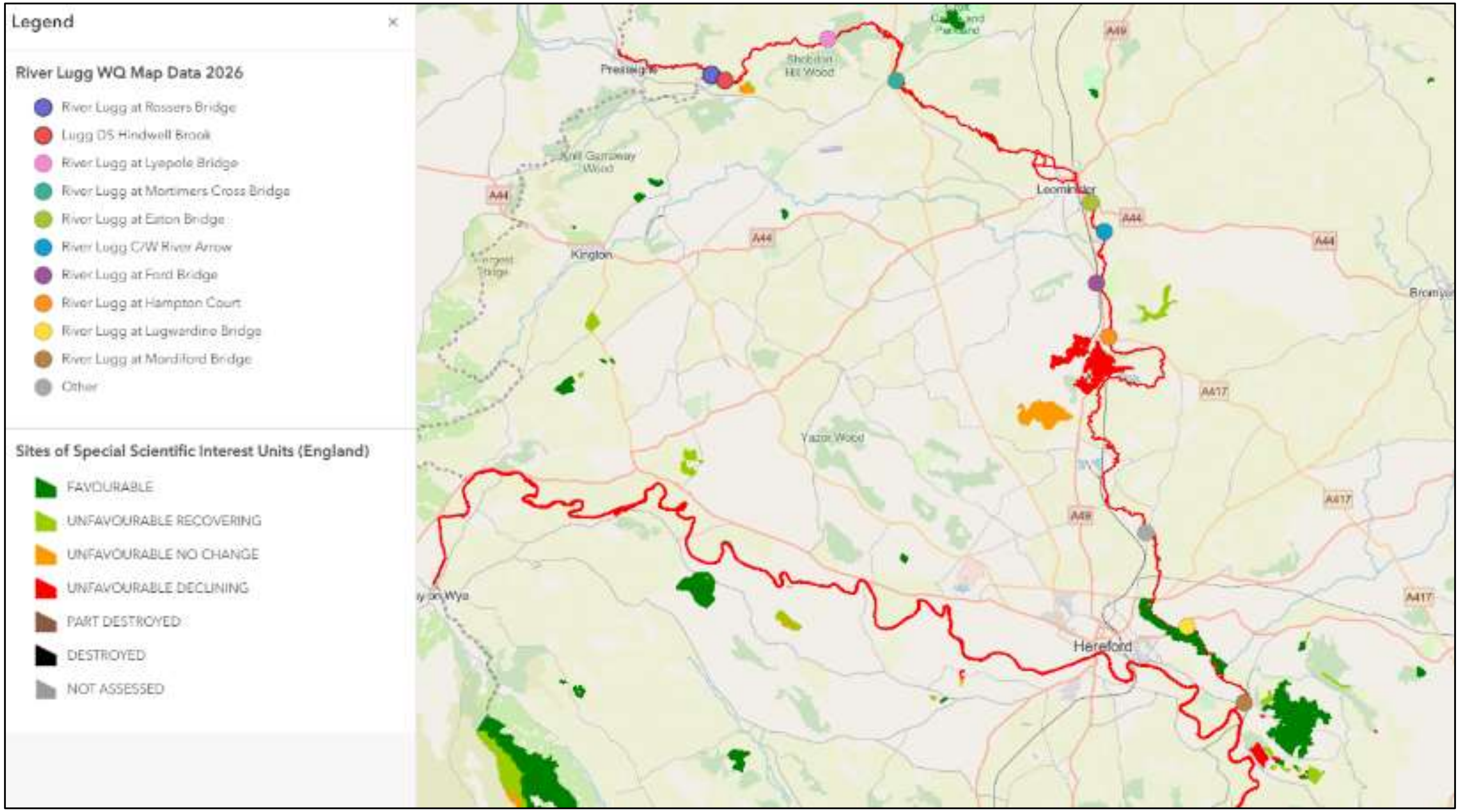
Data points relating to final effluents from sewage treatment works were not included as these were not sufficiently informative of the water quality within the river and hence the condition of the SSSI.

Plotted data was analysed and QA'd to detect anomalous values and where appropriate these were removed before averages were calculated. Three years of monthly data was used to generate average and or percentiles to undertake the condition assessment, in line with CSM guidance. See Table 8 below for a summary of the sites and any data limitations.

Table 8 River Lugg Water Quality Datasets (downstream → upstream sites)

Unit	Site	Period used in assessment	Limitations
1	R LUGG AT MORDIFORD BRIDGE	2023-01-01 to 2025-12-31	34–35 samples across 11/12 quarters. BOD limited to 10 samples across 5/12 quarters.
1	R LUGG AT LUGWARDINE BRIDGE	2023-01-01 to 2025-12-31	28 samples across 11/12 quarters. BOD limited to 13 samples across 7/12 quarters.
1	R LUGG AT WERGINS BRIDGE	2023-01-01 to 2025-12-31	31 samples across 12/12 quarters. No BOD data.
2	R.LUGG @ HAMPTON CRT.BDG.UPPER	2023-01-01 to 2025-12-31	31–32 samples across 11/12 quarters. No BOD data.
2	R LUGG AT FORD BRIDGE	2023-01-01 to 2025-12-31	32–34 samples across 12/12 quarters. BOD limited to 15 samples across 6/12 quarters.
2	R LUGG AT C/W R ARROW	2021-01-01 to 2023-12-31	24–25 samples across 11/12 quarters. No BOD data.
2	R LUGG AT EATON BRDGE, LEOMINSTER	2021-01-01 to 2023-12-31	14–22 samples across 8–10/12 quarters. No BOD data.
3	R LUGG AT MORTIMERS CROSS BRIDGE	2021-01-01 to 2023-12-31	18–26 samples across 9–11/12 quarters. Only 1 BOD sample available.
4	R LUGG AT LYEPOLE BRIDGE	2023-01-01 to 2025-12-31	33 samples across 11/12 quarters. BOD limited to 4 samples across 3/12 quarters.
4	LUGG DS HINDWELL BROOK	2023-01-01 to 2025-12-31	18 samples across 9/12 quarters. No BOD data.
4	R LUGG AT ROSSERS BRIDGE, PRESTEIGNE	2023-01-01 to 2025-12-31	18–19 samples across 8/12 quarters. No BOD data.

Figure 20. River Lugg Water Quality Monitoring Locations. Location ‘other’ refers to Wergins Bridge.



Results

Table 9 River Lugg Water Quality Condition Assessment Results – Organic Pollution

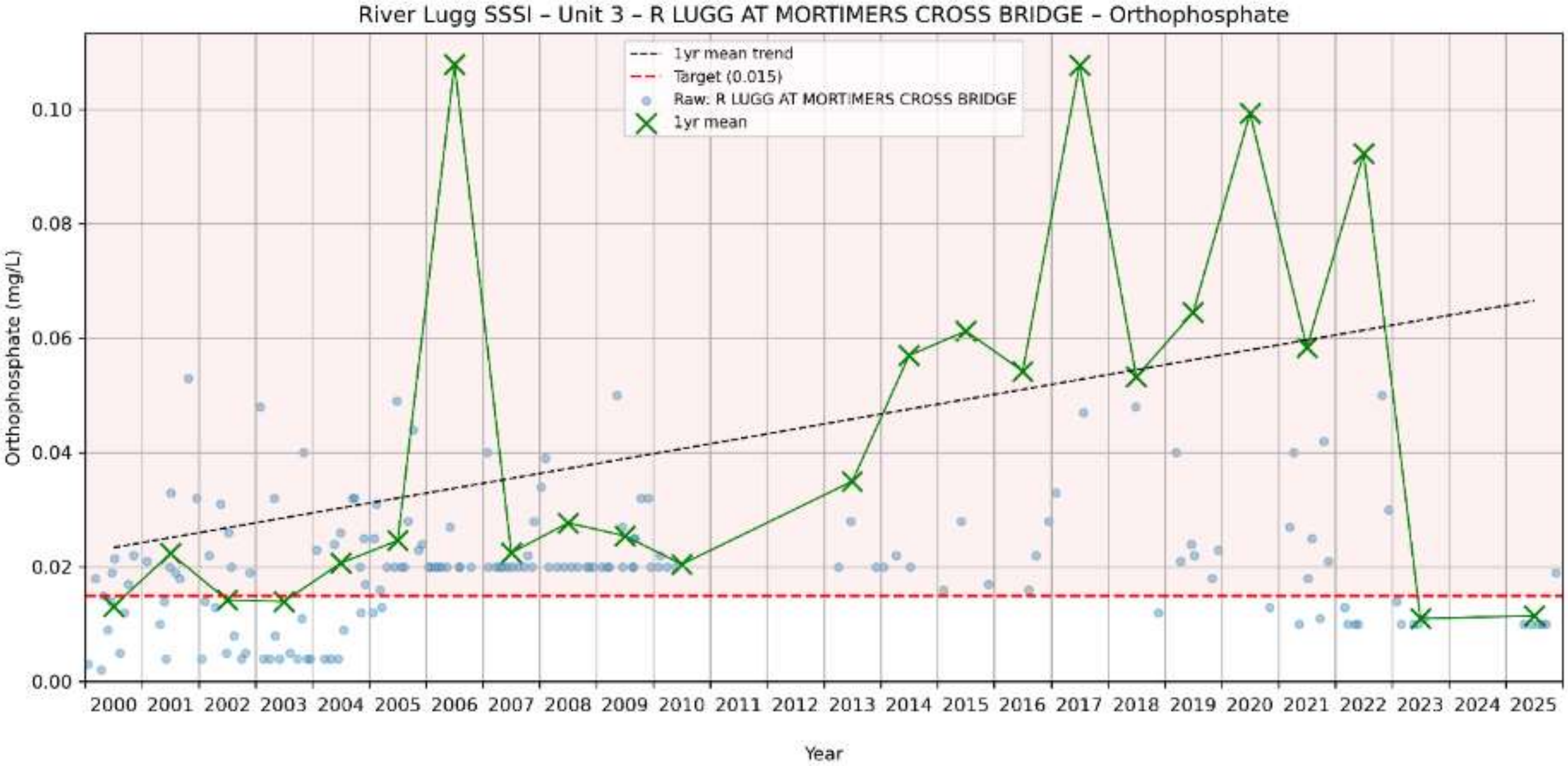
Parameter	Unit	Target	Result & compliance with target: Pass = Green | Fail = Red										
			1	1	1	2	2	2	2	3	4	4	4
			MORDIFORD BRIDGE	LUGWARDINE BRIDGE	WERGINS BRIDGE	HAMPTON COURT	FORD BRIDGE	R LUGG AT C/W R ARROW	EATON BRDGE	MORTIMERS CROSS BRIDGE	LYEPOLE BRIDGE	LUGG DS HINDWELL BROOK	ROSSERS BRIDGE, PRESTEIGNE
3 year 10%ile Dissolved Oxygen	(% saturation)	85	86.5	87.2	88.5	86.3	87	**84**	**83.8**	89.1	97.1	92.3	94.5
3 year 90%ile Total Ammonia	(NH3-N, mg L-1)	0.25	0.0513	0.065	0.0426	0.0827	0.0431	0.125	0.0344	0.03	0.0452	0.03	0.0314
3 year 95%ile un-ionised Ammonia	(NH3-N, mg L-1)	0.021	0.00132	0.00157	0.00121	0.00237	0.00132	0.00298	0.00101	0.00104	0.0014	0.000972	0.00119

Table 10. River Lugg Water Quality Condition Assessment Results – Nutrients. *Issue with phosphate data from 2022 & 2023 for Mortimers Cross Bridge, analysis requires revision.

Ortho-P	Unit	Target	Result & compliance with target: Pass = Green | Fail = Red										
			1	1	1	2	2	2	2	3	4	4	4
			R LUGG AT MORDIFORD BRIDGE	R LUGG AT LUGWARDINE BRIDGE	R LUGG AT WERGINS BRIDGE	R.LUGG @ HAMPTON CRT.BDG.UPPER	R LUGG AT FORD BRIDGE	R LUGG AT C/W R ARROW	R LUGG AT EATON BRDGE, LEOMINSTER	R LUGG AT MORTIMERS CROSS BRIDGE	R LUGG AT LYEPOLE BRIDGE	LUGG DS HINDWELL BROOK	R LUGG AT ROSSERS BRIDGE, PRESTEIGNE
3 year mean	mg/L	Unit 1,2 = 0.03; Unit 3,4 = 0.015	**0.0859 [186%]**	**0.0776 [159%]**	**0.0841 [180%]**	**0.0489 [63%]**	**0.0503 [68%]**	**0.0471 [57%]**	**0.0359 [20%]**	**0.0371 [147%]**	**0.0448 [199%]**	**0.0199 [33%]**	**0.0273 [82%]**
3 year Growing Season mean			**0.0824 [175%]**	**0.0663 [121%]**	**0.097 [223%]**	**0.0527 [76%]**	**0.0563 [88%]**	**0.0409 [36%]**	**0.0394 [31%]**	**0.0158 [5%]**	0.015	**0.0191 [27%]**	**0.0313 [109%]**

Orthophosphate Plots – Long Term Trends

Figure 21. River Lugg Unit 3 – Mortimers Cross Bridge – Orthophosphate.



57

Figure 22. River Lugg Unit 2 – Eaton Bridge – Orthophosphate

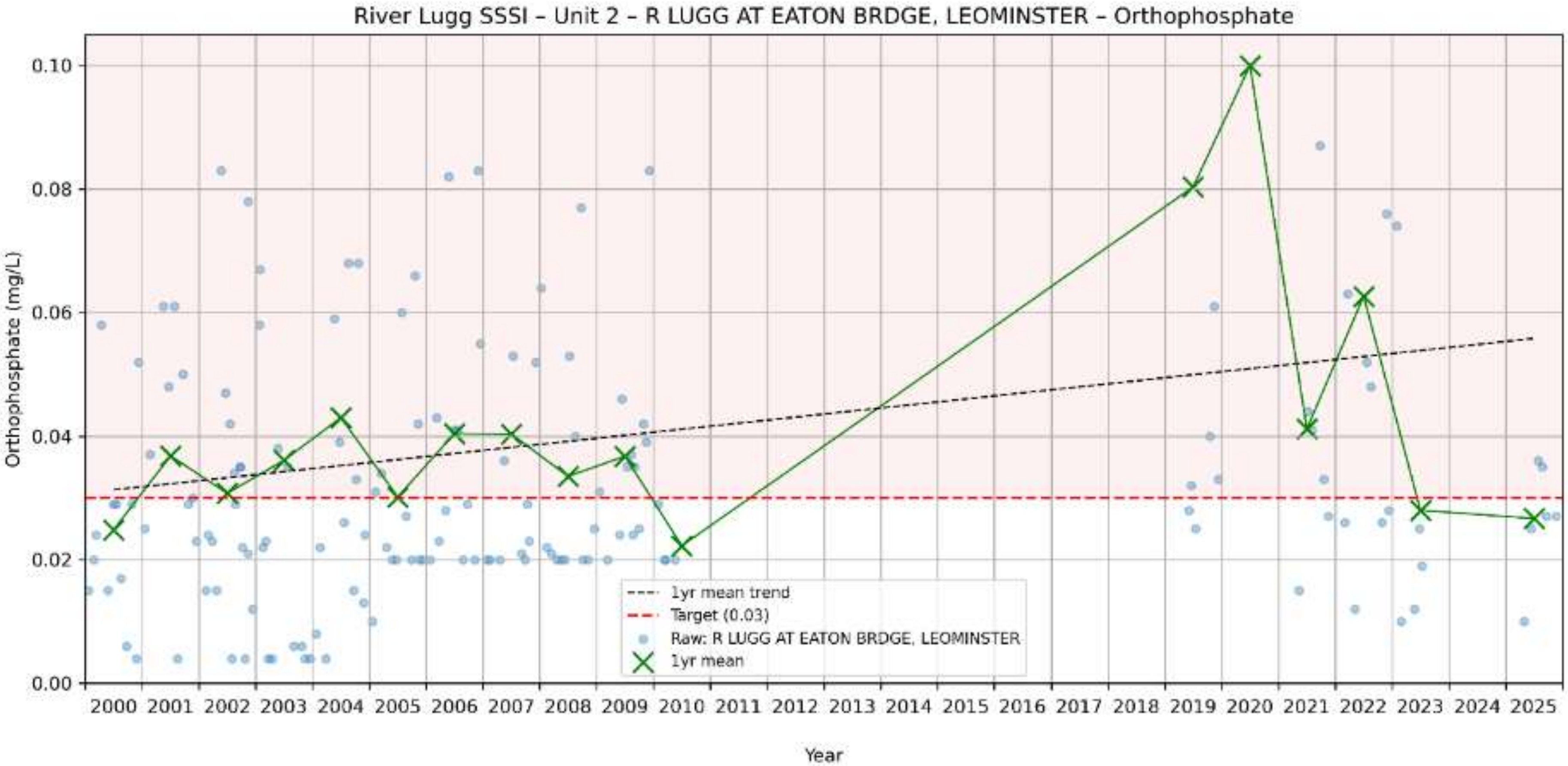


Figure 23. River Lugg Unit 2 – River Lugg C/W Arrow – Orthophosphate

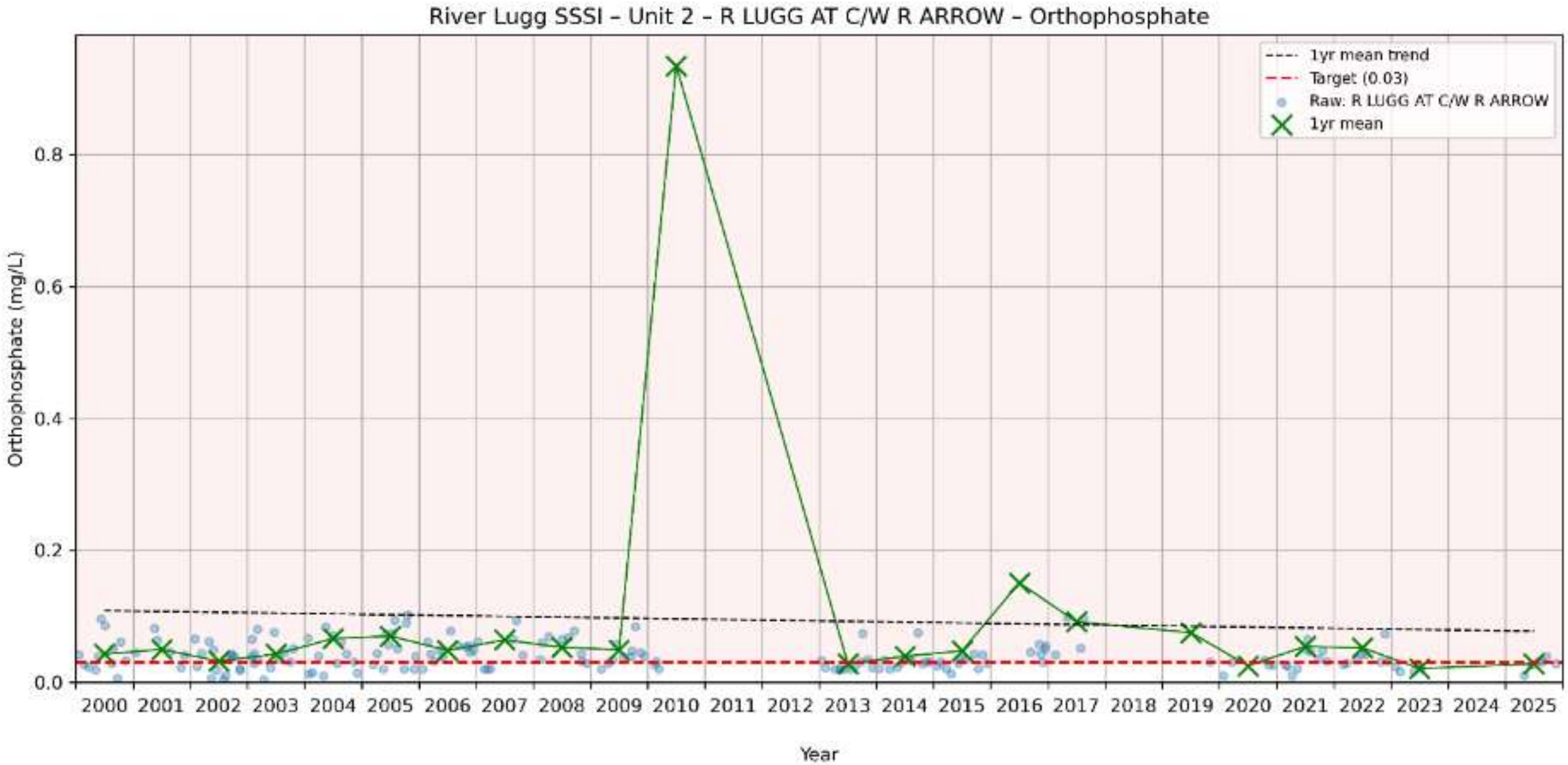


Figure 24. River Lugg Unit 2 – Ford Bridge – Orthophosphate

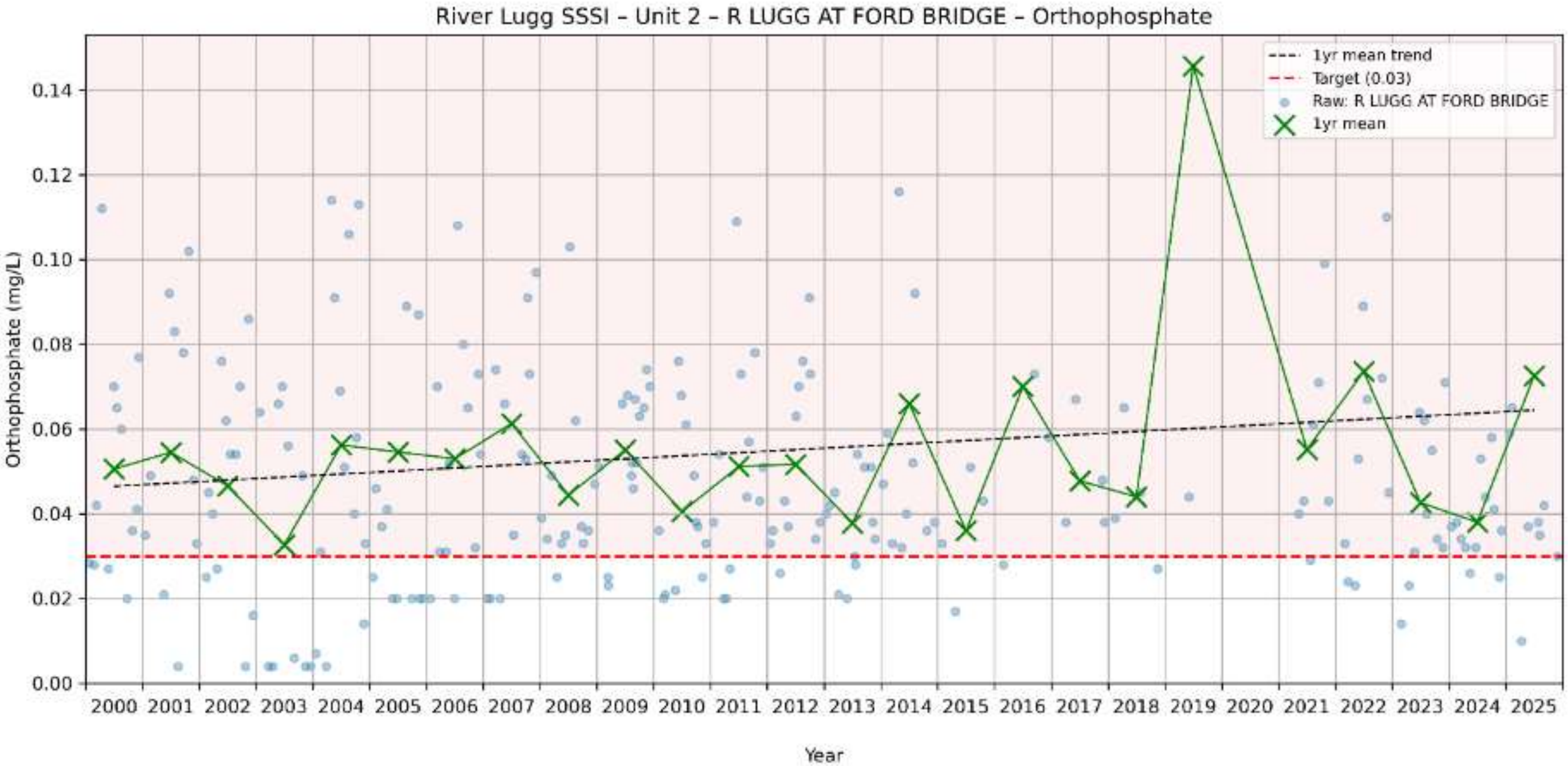


Figure 25. River Lugg Unit 2 - Hampton Court – Orthophosphate

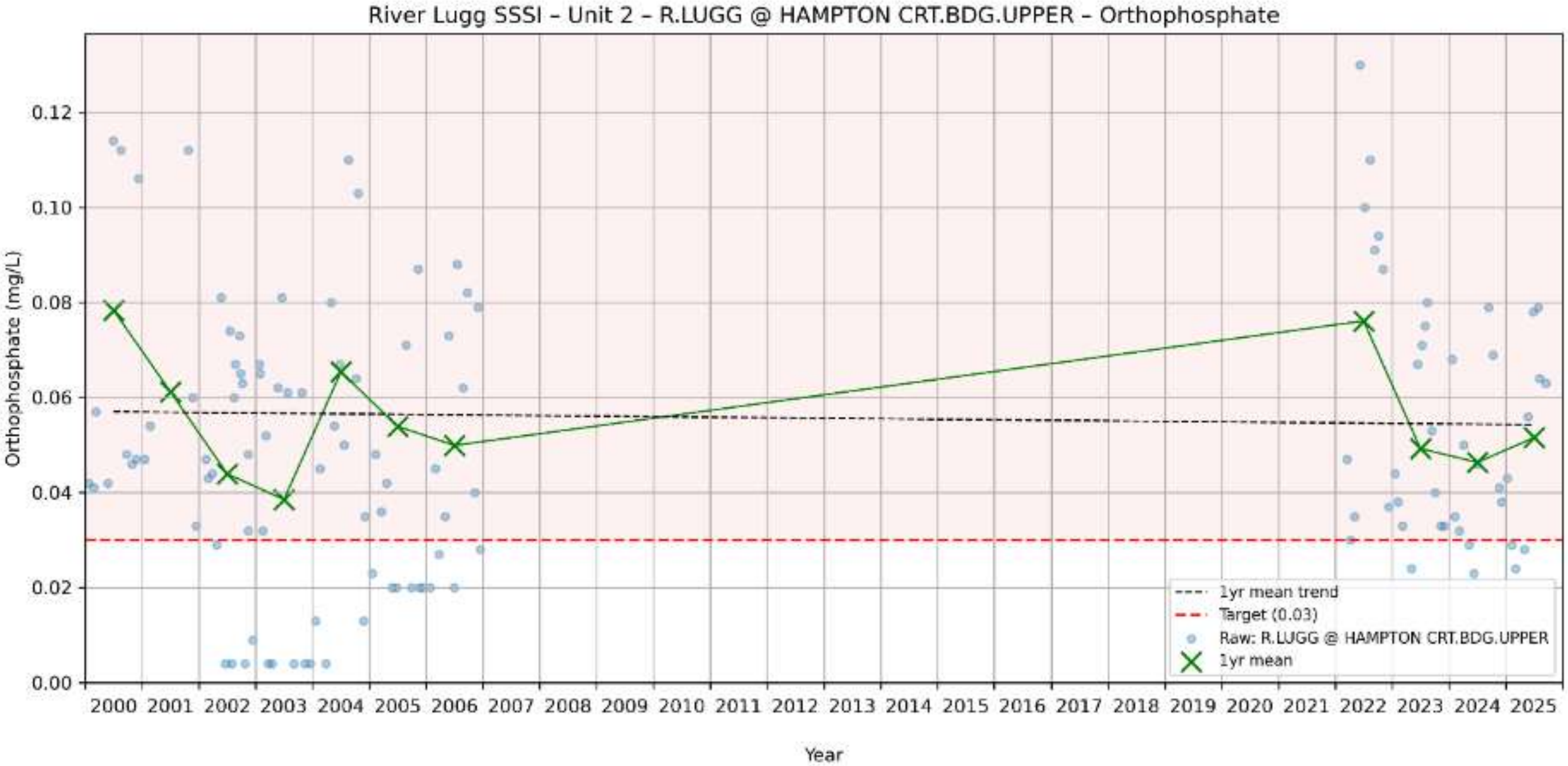


Figure 26. River Lugg Unit 1 – Wergins Bridge – Orthophosphate

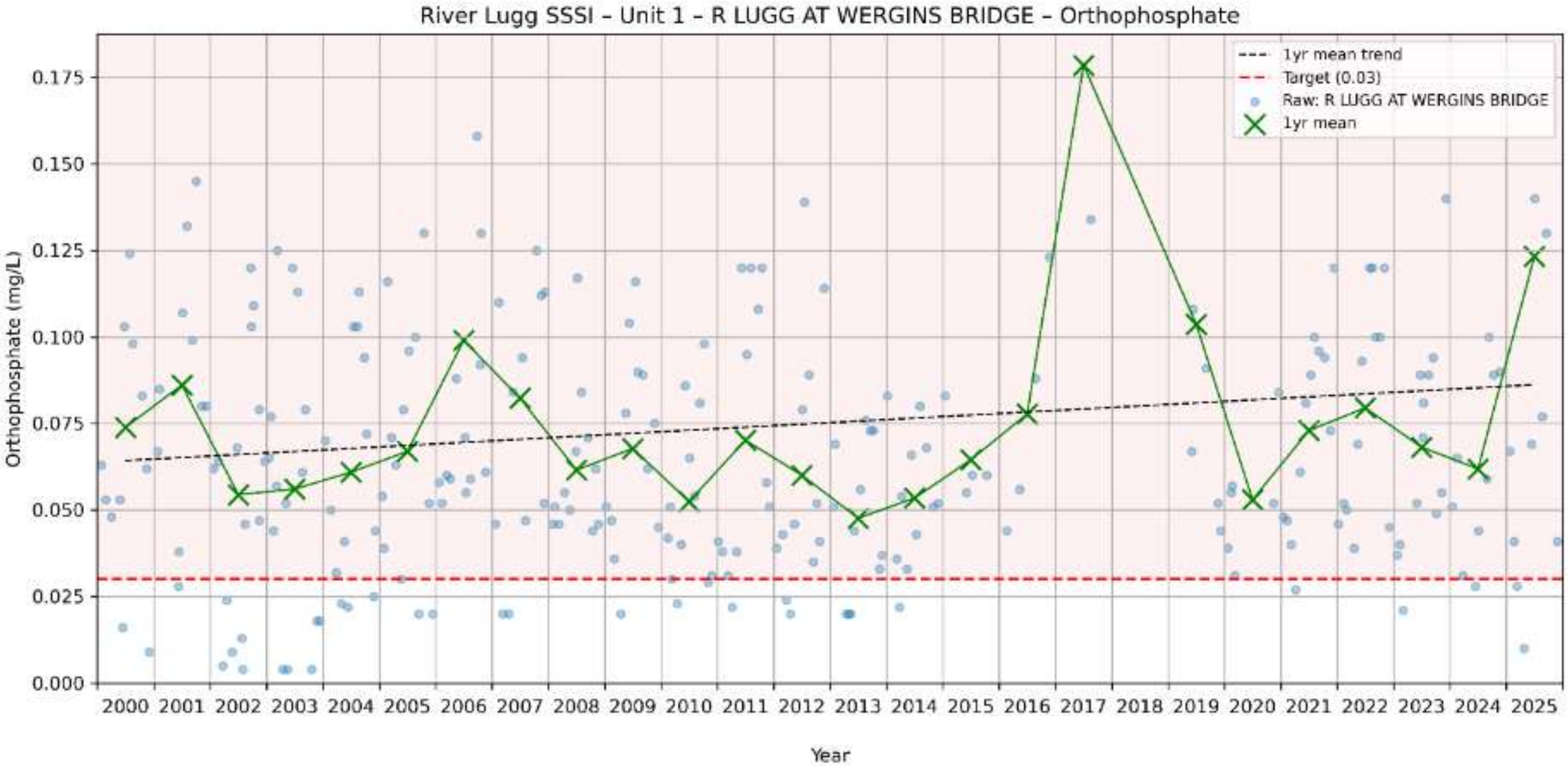


Figure 27. River Lugg Unit 1 – Lugwardine Bridge – Orthophosphate

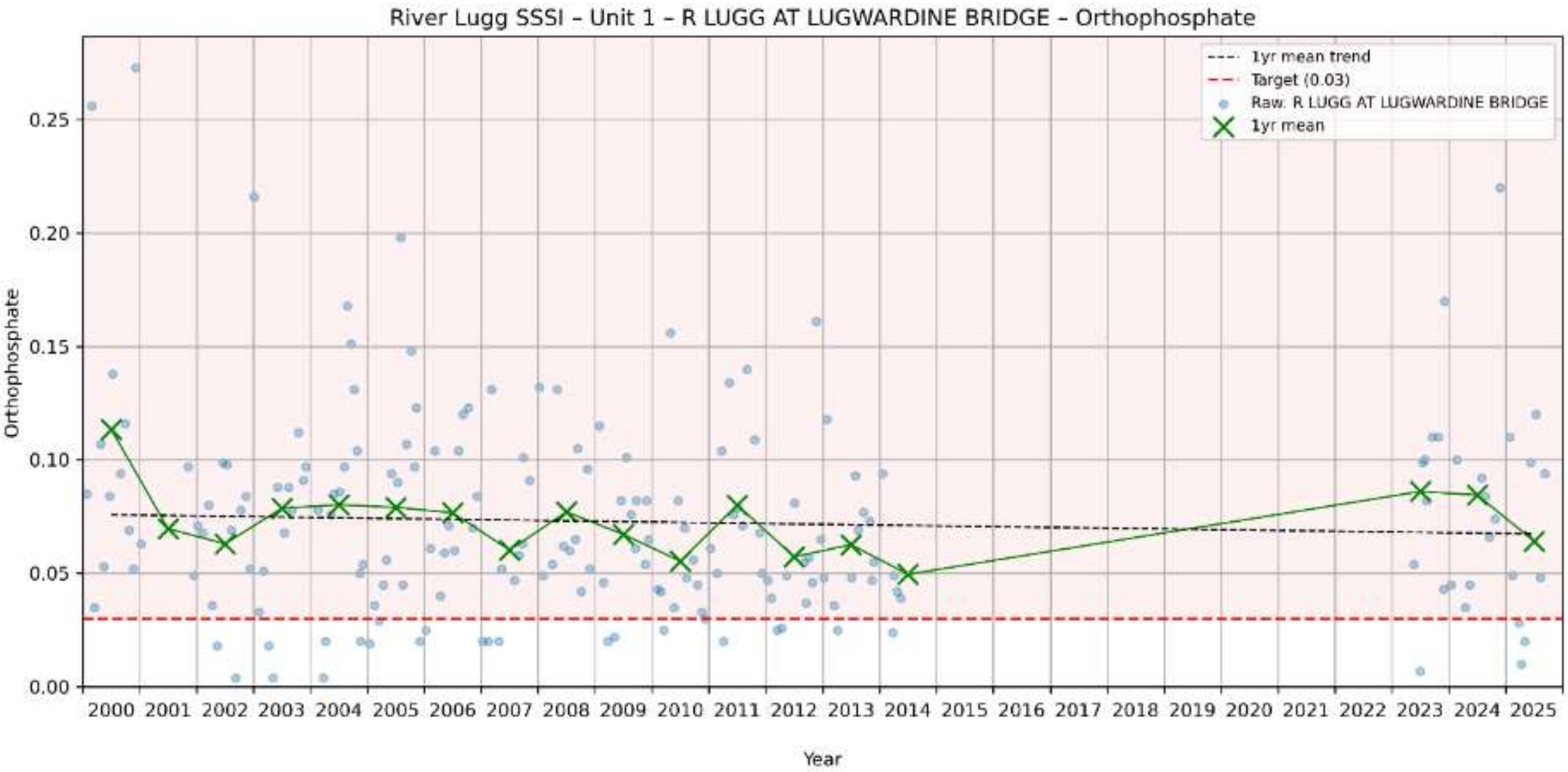
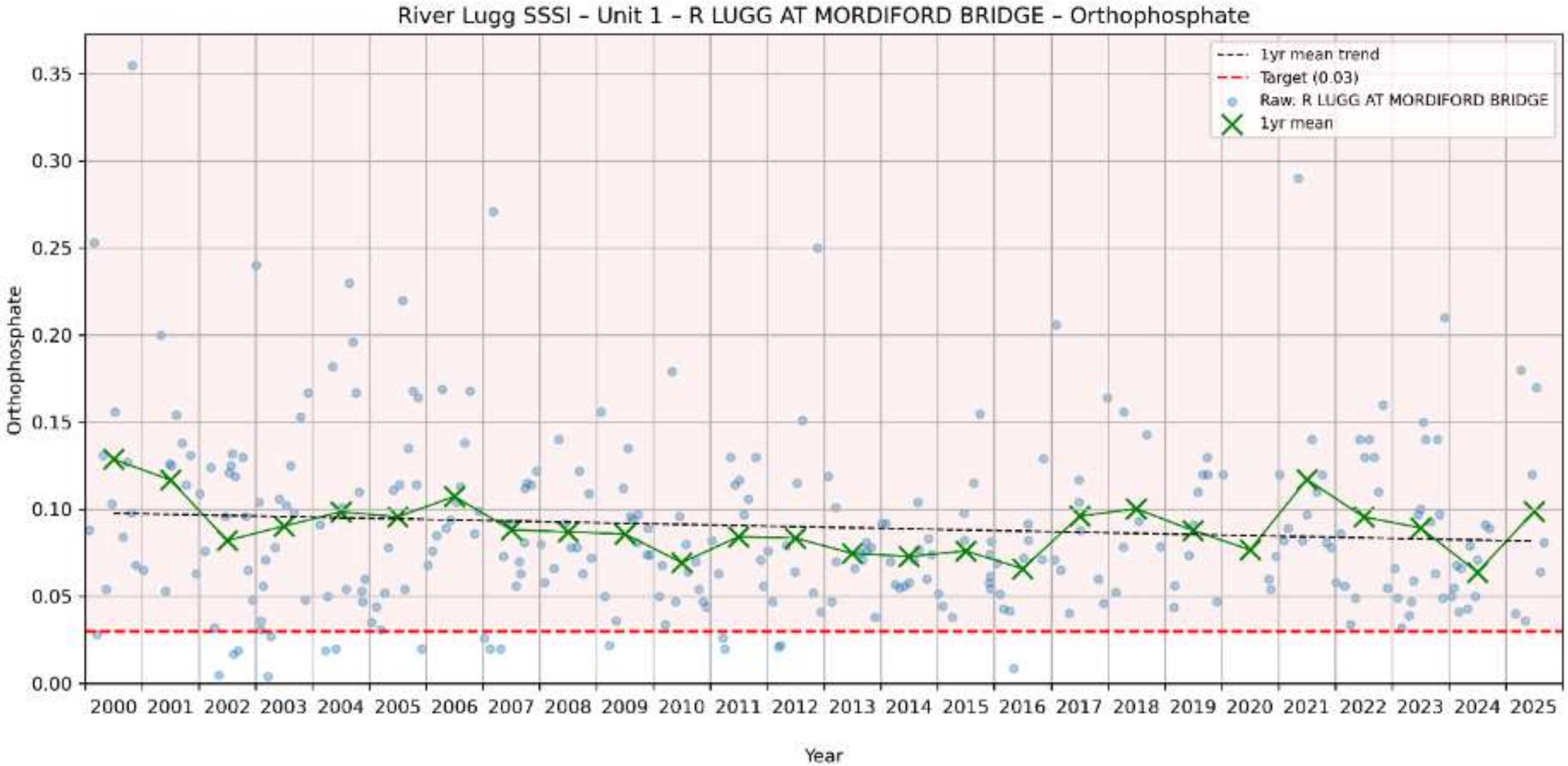


Figure 28. River Lugg Unit 1 – Mordiford Bridge – Orthophosphate



Condition Assessment

Dissolved Oxygen: Fail*

Target: 10%ile DO >85%

Monitoring along the River Lugg indicates that dissolved oxygen saturation is generally within biologically accepted thresholds, with oxygen % saturation remaining at consistent saturation levels over the 25-year period assessed. There are no clear trends indicating an improvement or decline across sites. No major oxygen sags are recorded, indicating that the sampling is not picking up significant pollution events.

*River Lugg at Eaton and C/W Arrow (unit 2) both marginally failed dissolved oxygen saturation targets with the 10^{th} %ile recorded at 84%. Ford bridge also records a fluctuation in site compliance. The site consistently failed the compliance targets between 2000 – 2023 & also dropped below target in 2025. However, on average in the last three years the site has been compliant for DO. Hindell brook also failed for DO in 2022, however passed in 2023 – 2025. Overall, percentage oxygen saturation is considered to be within required thresholds across the site to support favourable condition.

Low levels of dissolved oxygen can be indicative of pollution. The pollution can originate from a range of sources including effluent discharge and excess fertilizer. When the concentration of dissolved oxygen gets too low, fish and other aquatic life can die. Low DO values can also be associated with low flows and poor habitat quality.

Mean Biological Oxygen Demand (BOD): Pass (low confidence)

Target: mean BOD below 1.5 mg L^{-1}

Available data for BOD is sparse, with no sites having a full three years of data available for analysis. However, where data is available the site is compliant for its BOD targets.

Biological Oxygen Demand is an indicator of organic pollution and can be correlated to microbiological contamination. High BOD concentrations reduce the availability of oxygen in the system and have similar consequences to low dissolved oxygen.

Total Ammonia: Pass

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Target: 90%ile < 0.25

Across the River Lugg, Total Ammonia concentrations are significantly below the compliance threshold and over the long term three sites have recorded a decline in episodic spikes and decreasing concentration (Lugwardine bridge, Mordiford bridge and Ford bridge). This indicates that the pollution pressure from ammonia across the lower catchment has declined over the past 25 years.

High levels of Total Ammonia in freshwater systems can have a direct toxic impact on freshwater species.

Un-ionised Ammonia: Pass

Target: 95%ile < 0.021

All monitoring locations demonstrate compliance with the unionised ammonia target. Concentrations are significantly below the required threshold for compliance.

Organic Pollution

Overall, the available data for dissolved oxygen, biological oxygen demand and ammonia indicates that organic pollution is generally not having a significant impact on water quality across the Lugg catchment.

Orthophosphate: Fail

Target: Unit 3,4 = 0.015; Unit 1,2 = 0.03

Orthophosphate Assessment Summary

Orthophosphate concentrations exceed the CSM targets at almost all monitoring locations throughout the River Lugg SSSI. Annual mean concentrations fail the target at all eleven monitoring sites, while growing season concentrations only achieve the target at Lyepole Bridge and are marginally above target at Mortimer's Cross.

Unit 1

Unit 1 has the highest phosphate concentration with annual averages almost double the concentrations in upstream unit 2. Annual mean concentrations range from **0.078–0.086 mg/L**, approximately **160–190% above the target** of 0.03 mg/L. Growing season concentrations are similarly elevated, with exceedances of **120–220% above target**. These results indicate severe and persistent nutrient enrichment throughout the lower reaches.

Unit 2

Phosphate concentrations remain consistently above the target throughout Unit 2. Annual mean concentrations range from 0.036 – 0.05 mg/L which exceed the target by approximately **20–70%**, while growing season means exceed the target by **30–90%**. Although concentrations are lower than those observed in Unit 1, nutrient enrichment remains widespread and significant.

Unit 3

Phosphate concentrations are slightly lower in Unit 3 averaging 0.037 mg/L annual average. At Mortimer's Cross, the annual mean concentration exceeds the target by only **5%** during the growing season, however by **147%** on the three-year annual mean due to occasional elevated values.

Unit 4

Unit 4 exhibits mixed results. Hindwell Brook and Rossers Bridge remain above the target, with annual mean concentrations exceeding the target by **33%** and **82%**, respectively. Lyepole Bridge records the highest annual exceedance within the upper catchment (**199% above target**), although the growing season mean achieves the target exactly (**0.015 mg/L**), suggesting that elevated concentrations may be driven by seasonal or episodic inputs outside the growing season.

Summary

The results indicate that **phosphate enrichment is a chronic pressure throughout the River Lugg SSSI**. The widespread failure of phosphate targets is consistent with nutrient enrichment remaining a major factor contributing to the unfavourable condition of the river habitat feature.

Long term trends (2000 – 2025)

Unit 1 (Lower Lugg)

Mordiford Bridge (figure 28)

This is one of the more stable sites with annual means fluctuate around 0.08–0.10 mg/L throughout the record with only a very slight decline in the fitted trend line. Recent years remain substantially above target. There is persistent, severe phosphate enrichment with no evidence of sustained improvement.

Lugwardine Bridge (figure 27)

The fitted trend is slightly downward; however, this is skewed by the 2000 data set where annual averages were significantly higher than the proceeding years. Annual means in the early 2000’s ranged from 0.08–0.17 mg/L in the early 2000s to approximately 0.06–0.08 mg/L 2023-2025. Annual concentrations remain more than double the target.

Wergins Bridge (figure 26)

The trend line shows a gradual increase from approximately 0.075 mg/L in 2000 to approximately 0.125 mg/L by 2025. Annual means remain consistently above the 0.03 mg/L target. There is substantial year-to-year variability, including a notable spike in 2017. Overall the data indicates indicates persistent nutrient enrichment with evidence of a weak deteriorating trend.

Unit 2 (Middle Lugg)

Hampton Court (figure 25)

Appears broadly stable around 0.04–0.06 mg/L. The apparent negative trend is largely driven by the gap in monitoring between 2006 and 2022, making the regression line unreliable.

Ford Bridge (figure 24)

Shows a positive upward trend. Annual means were generally 0.04–0.06 mg/L during the 2000s but have more frequently exceeded 0.06–0.07 mg/L since 2015, with a major spike in 2020. The fitted trend is clearly positive indicating a deterioration in water quality.

C/W River Arrow (figure 23)

This site is difficult to interpret because the 2010 annual mean (~0.9 mg/L) dominates the trend. Without that single extreme year the record would look broadly stable with 2023 and 2025 close to compliant.

Eaton Bridge (figure 22)

This site shows one of the clearest deteriorating trends. In the early 2000’s the site was frequently close to and below the target, whereas 2019–2022 experienced markedly elevated concentrations. Recent values have fallen again, but the long-term trend remains upward.

Unit 2 conclusion

Unit 2 shows evidence of long-term deterioration in phosphate concentrations at Ford Bridge and Eaton Bridge. Although concentrations fluctuate substantially between years, recent values generally remain above those recorded during the early 2000s.

Unit 3

Mortimer's Cross (figure 21)

The early record (2000–2010) is largely around 0.015–0.03 mg/L. From around 2013 onwards there is a marked step change, with annual means frequently increasing to 0.05–0.10 mg/L. The regression line shows a very strong upward trend. However, the most recent years (2024–2025) are below target compliance.

There is evidence of a substantial deterioration in phosphate concentrations during the mid-2010s, followed by a marked recent improvement. Additional monitoring will be required to determine whether the recent reduction represents sustained recovery or short-term variability.

Unit 4 (Upper Lugg)

There are no long-term monitoring records for unit 4.

See Appendix X for long term data plots & raw data outputs.

WFD Water Quality Analysis: Chemicals

Feature compliance: Fail

There are two WFD waterbodies covering the River Lugg SSSI. Data from the environment agency catchment data explorer is presented below. Both water bodies fail for the Chemical assessment. In the upper Lugg, failure is driven by Mercury, PFOS & PBDE failures. In the Lower Lugg, Mercury and PBDE both fail the compliance thresholds. Phosphate classifications have deteriorated in both the Upper and Lower Lugg from High/Good in the 2010’s to Moderate by 2022.

Upper Lugg (Unit 4, 3 & 2): Lugg confluence Norton Brook to confluence River Arrow Water Body (Water Body IDGB109055042030)

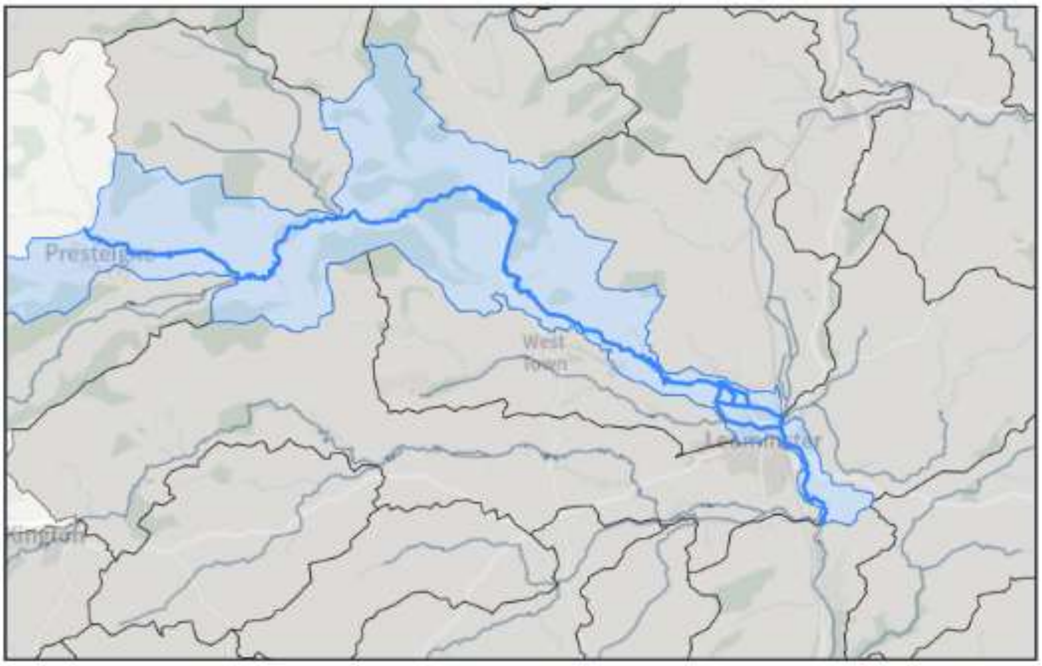

Table 11 WFD Phys-Chem Results Upper River Lugg

Year	2013	2014	2015	2016	2019	2022
Ammonia	High	High	High	High	High	High
Dissolved oxygen	High	High	High	High	High	High
Phosphate	High	High	High	Good	Moderate	Moderate
Temperature	High	High	High	High	High	High
pH	High	High	High	High	High	High

Table 12. WFD Chemical Results Upper Lugg (2019)

Chemical	Fail
Priority hazardous substances	Fail
Benzo(a)pyrene	Good
Dioxins and dioxin-like compounds	Good
Heptachlor and cis-Heptachlor epoxide	Good
Hexabromocyclododecane (HBCDD)	Good
Hexachlorobenzene	Good
Hexachlorobutadiene	Good
Mercury and Its Compounds	Fail
Perfluorooctane sulphonate (PFOS)	Fail

Polybrominated diphenyl ethers (PBDE)	Fail
Priority substances	Good
Cypermethrin (Priority)	Good
Fluoranthene	Good
Nickel and Its Compounds	Good

Lower Lugg (Unit 2 & 1): Lugg - conf R Arrow to conf R Wye Water Body (Water Body IDGB109055036790)

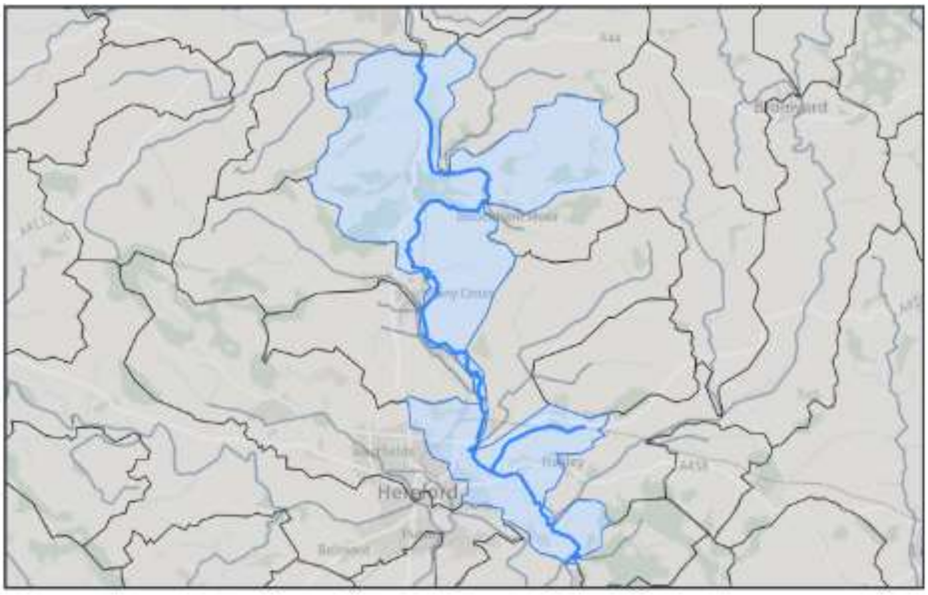

Table 13. WFD Phys-Chem Results Upper River Lugg

Year	2013	2014	2015	2016	2019	2022
Ammonia	High	High	High	High	High	High
Biochemical Oxygen Demand	High	High	High	High		High
Dissolved oxygen	High	High	High	High	Good	High
Phosphate	Good	Good	Good	Good	Good	Moderate
Temperature	High	High	High	High	High	High
pH	High	High	High	High	High	High

Table 14. WFD Chemical Results Lower Lugg (2019)

Chemical	Fail
Priority hazardous substances	Fail
Benzo(a)pyrene	Good
Dioxins and dioxin-like compounds	Good
Heptachlor and cis-Heptachlor epoxide	Good
Hexabromocyclododecane (HBCDD)	Good
Hexachlorobenzene	Good
Hexachlorobutadiene	Good

Hexachlorocyclohexane	Good
Mercury and Its Compounds	Fail
Pentachlorobenzene	Good
Perfluorooctane sulphonate (PFOS)	Good
Polybrominated diphenyl ethers (PBDE)	Fail
Quinoxyfen	Good

Discussion

The results from the water quality monitoring indicate that across the Lugg, organic pollution is not posing a threat to the favourable conservation status of the site. This is supported by the analysis in this report and the WFD monitoring results, which classify the Lugg as High status for Ammonia and Dissolved Oxygen.

Long-term orthophosphate trends indicate persistent nutrient enrichment throughout the River Lugg SSSI. Concentrations remain above CSM targets at most monitoring locations. Unit 1 shows chronic phosphate enrichment with little evidence of sustained recovery, whilst several Unit 2 sites exhibit long-term deterioration. Mortimer's Cross displays evidence of a marked increase in phosphate concentrations during the mid-2010s, although recent results suggest possible improvement. Monitoring records in Unit 4 are currently insufficient to establish robust long-term trends. Overall, there is no evidence of catchment-scale recovery in phosphate concentrations across the River Lugg SSSI.

The analysis of phosphate data is supported by the results of the WFD water quality monitoring, which report Phosphate deterioration in both the Upper and Lower Lugg WFD water bodies. In the Upper Lugg Phosphate declined from High (2015) → Good (2016) → Moderate (2019). In the Lower Lugg Phosphate deterioration has been recorded Good (2019) → Moderate (2022).

Catchment wide measures to address diffuse water pollution are urgently required to significantly decrease catchment sources of phosphate pollution. The conversion of arable cropping in the floodplain to low intensity semi-natural habitat should be a priority.

Field drainage is extensive across the Lugg catchment. Catchment drainage increases the conveyance of sediment bound phosphate. Measures to mitigate the conveyance of sediment bound phosphate should also be urgently investigated.

The Environment Agency have published an updated Diffuse Water Pollution plan for the River Wye Catchment in 2025. The actions in this plan should be urgently implemented to address diffuse pollution pressures across the catchment.

Habitat Structure

Overview

The physical structure of a river is fundamental to its natural functioning. Rivers have been modified and changed in the UK over hundreds, if not thousands of years (Holmes & Raven, 2018).

Understanding the physical geomorphology enables an understanding of the driving factors influencing the ecology of a river system, ensuring restoration is directed to where it is most needed.

Method

River Habitat Survey is a method designed to characterise and assess the physical structure of freshwater streams and rivers, including recognition of vegetation types and basic geomorphological principles and processes.

The Habitat Structure is assessed via processing and analysing the results of the River Habitat Surveys (RHS). Earth observation data and information from supplementary reports including river restoration plans and geomorphological surveys have also been used to inform the assessment.

Table 15 provides a summary of the Habitat Structure attributes assessed as part of the CSM condition assessment.

Table 15 Habitat Structure Attributes.

Attribute	Summary	Method of assessment
Channel planform	Channel form should be generally characteristic of river type, with predominantly unmodified planform.	Assess planform via comparison map data (ESRI world imagery 2025) against historic OS maps from different reference periods (OS 1830 – 1880 & OS 1880 – 1915). Supplemented with RHS survey results, historical records, local knowledge and documentation from the geomorphological appraisal and river restoration plan.
Habitat Modification Score (HMS)	HMS scoring criteria indicate the degree of modification of the river habitat, with a higher score indicating a higher degree of modification.	RHS
Riparian Zone Vegetation Naturalness (RZVN)	Assessment of how natural / native the Riparian Zone of the assessment unit is.	RHS transect data

Large Woody Debris (LWD)	'Whole trees or large trunks and branches' swept downstream and lodged in the channel or on the banks' as defined in RHS. LWD plays an important role in increasing river habitat diversity, shelter for fish, food source for aquatic invertebrates etc.	RHS Data
In-Channel Structures	Artificial in-channel structures e.g. weirs, may constitute barriers to the free movement of water, aquatic organisms, sediment. This impacts the riverbed structure and hydrology downstream & upstream.	Expert judgement. Data sources: • Aerial imagery • RHS data • Geomorphological appraisal • River Lugg Restoration Plan

Habitat Modification & Habitat Quality

River Habitat Survey data is used to calculate several different indices which classify the quality of the river habitat. The Habitat Modification Score (HMS) quantifies the impact of physical engineering structures on the river channel. The Habitat Quality Assessment (HQA) score is a measure of the diversity of natural habitat features, land use and floodplain features. This includes the channel substrate types, numbers of riffles & pools.

To interpret HQA scores, 'context analysis' is employed to assess the sites HQA score against the distribution of HQA scores for similar sites. The score for each index is categorised into five classes. The HMS class describes the pressure and impact of engineering structures.

The HQA classes are on a scale of 1 (top 20% of similar sites) to 5 (bottom 20% of similar sites) and describes the pressure and impact from agricultural fine sediment and hydro morphological impact.

The River Habitat Quality (RHQ) index is a combination of the HQA and HMS classes. This is an overall score of the integrity and quality of the river habitat.

Whilst only the HMS is used directly for assessing conservation status, the additional metrics provide useful additional context for each survey.

Table 16 River Habitat Score Indices Descriptions.

Score	HMS Description	HQA Description	RHQ Description
1	Pristine/semi-natural	Very natural	Excellent
2	Predominantly unmodified	Natural	High
3	Obviously modified	Moderately natural	Moderate
4	Significantly modified	Weakly natural	Low
5	Severely modified	Little natural	Very poor

For further information on calculating River Habitat Indices refer here

Field Survey

The River Habitat Survey sites were selected to align with previous EA RHS locations where possible, to understand any change in site condition over time. Twenty RHS & Phase 1 surveys were undertaken across the four SSSI units, resulting in ~13% cover of the SSSI (Table 7).

The surveys were carried out along the standard 500m stretch of river channel, with observations made at ten equally spaced spot checks. Observations of land use and valley form in the river corridor are noted to provide additional context. The surveys are carried out according to the methodology given in the River Habitat Survey Guidance Manual: 2003 Version" (Environment Agency, 2003.

Alongside the RHS surveys, an assessment of the naturalness of the riparian vegetation at each transect was carried out by a Phase 1 habitat assessment, an approach modified from the SERCON 2 technical manual (SERCON attribute NA 5 – Naturalness: Plant Assemblages on the Banks) (Boon et al, 1996).

The RHS surveys were carried out by Natural England surveyors & Environment Agency monitoring staff over two weeks from the 23rd – 25th July & 05th – 08th September 2025. The survey teams were led by Daisy Burris (Senior Officer Freshwater Monitoring, RHS accredited surveyor: certification number DG086), Fergus Mitchell (Senior Freshwater Officer, RHS accredited surveyor: certification number FA039) & Jason Doe (Senior Environmental Monitoring Officer, certification number: DG007).

Access was generally good throughout survey reaches. Steep banks and dense vegetation along two reaches resulted in some surveys where full access along the river channel was not possible. This is documented in Table 17. Weather conditions were warm and dry during the two weeks of surveys. Flows in the River Lugg were low.

Analysis

RHS surveys were input into the RRC RHS toolbox, to generate the following indices:

- Habitat modification (HMS)
- Habitat Quality Assessment Score (HQA)
- River Habitat Quality Class (RHQ)

Table 17 River Lugg RHS survey locations

Unit	Site	Spt6 GR	Survey Date	RHS Surveyor	Adverse conditions
4	1	SO3119164822	23/09/2025	DG086	No, entire river bed visible, no access constraints.
	2	SO3510763854	23/09/2025	DG086	No, entire river bed visible, no access constraints.
	3	SO3725965247	24/09/2025	DG086	No, entire river bed visible, no access constraints.
	4	SO4141966033	07/07/2025	DG086	No, entire river bed visible, no access constraints.
3	5	SO4275564719	06/07/2025	DG007	No, river bed partially visible, no access constraints.
	6	SO4655861210	07/07/2025	DG086	No, river bed partially visible, no access constraints.
2	7	SO4811960666	05/07/2025	FA039	No, bed only partially visible, no access constraints.
	8	SO5075657660	05/07/2025	DG086	No, river bed entirely visible, no access contraints.
	9	SO5113756293	07/07/2025	DG086	No, river bed barely visible, no access contraints.
	10	SO5119954720	04/07/2025	DG086	No, river bed barely visible. Difficult to access the river at most spot checks due to thick scrubby margines, access constraints along this section
	11	SO5149253158	n/a	n/a	Site not able to be surveyed due to access restrictions
	12	SO5171852196	04/07/2025	DG086	No access constraints, river bed partially visible
1	13	SO5247350898	05/07/2025	FA039	No, river partially visible
	14	SO5102850003	06/07/2025	DG086	Yes, river largely innacessible to survey.
	15	SO5064649341	24/09/2025	DG086	No, river partially visible, access difficult due to thick ruderal vegeation along riparian corridor and steep banks.
	16	SO5112446933	06/07/2025	DG007	No, river bed barely visible
	17	SO5309544495	06/07/2025	FA039	No, partially visible, no restrictions
	18	SO5315641156	06/07/2025	Fergus Mitchel	No, bed partially visible
	19	SO5489740439	06/07/2025	DG007	No, bed partially visible
	20	SO5588438962	25/09/2025	DG086	No, bed partially visible
	21	SO5650438254	25/09/2025	DG086	No, river bed barely visible

General River Characteristics

Along the length of the River Lugg the valley form is variable. In the upper reaches the river flows through a predominantly shallow valley, although sections cut through gorges and deeper basins. The middle and lower Lugg valley is also predominantly a shallow vee, with some reaches flowing through an asymmetrical valley. Towards the confluence with the Wye the topography flattens out and there are no obvious valley sides.

The gradient along the length of the river is fairly low. The channel width varies from 5m in the upper Lugg near Presteigne to 15-25m in the lower Lugg near the confluence with the Wye. The banks of the river are predominantly comprised of exposed earth & clay.

From Presteigne to Leominster the river is actively meandering across the flood plain & is in a predominantly natural physical state. The flows are swift and there is generally good connectivity to the floodplain. The river is characterised by a gravel pebble bed and exhibits classic riffle pool sequences. Erosional and depositional features are ubiquitous with bars, cliffs and islands all common. The modifications present are generally spatially discrete and have a localised impact on geomorphological processes. The main impacts are a result of weirs slowing and ponding flows, preventing river processes from being active and reducing the in-channel diversity.

There is a stark transition in river character near Leominster where the river has been significantly altered for flood protection & agricultural improvement. The Upper Lugg Improvement Scheme was undertaken upstream of Leominster to protect agricultural land. Major flood alleviation works have been undertaken around Leominster including building a bypass channel, extensive drainage, re-sectioning & embankments. The works were undertaken from the 1950's to the 1970's for flood alleviation & major works continued into the 1980's for 'channel improvement' and navigation.

Downstream of Leominster the river has been modified along significant stretches for navigation and drainage purposes. The river is downcutting along many reaches and where the river is over deepened flows are slower. The banks are steep to vertical along many sections (+3m), embanked and disconnected from the floodplain. Where the riverbed was accessible it was predominantly recorded as gravel pebble. Naturally functioning sections are present in the lower reaches, and some sections have re-naturalised. The re-naturalised sections are characterised by side and point bars however generally remain disconnected from the floodplain. For a full account of historic channel modifications refer to the River Lugg Restoration Technical Report (Jacobs, 2015)

Physical Modification Results: Habitat Modification & Planform

Planform Target = ≤ 5% of the assessment unit should be artificial, re-aligned or constrained.

Habitat Modification target = ≥65% or more of condition monitoring sites should fall within the semi-natural HMS class 1, with the remainder predominantly unmodified (class 2).

Unit 4

Planform: Pass
Habitat Modification: Fail (in-channel structures)

Unit 4 from Presteigne to Aymestry is predominantly physically unmodified. The river has a gravel-pebble bed, is in connectivity to the floodplain and displays a range of natural erosional and depositional features. However, weirs & minor fords are present throughout the unit, which result in the overall assessment unit failing for the physical habitat modification component.

Planform analysis through comparison with historic maps map (OS 1830 – 1880's county layers) indicates that the channel planform has not been altered during the last ~200 years. The channel follows a similar sinuous meandering course. Alterations to planform have occurred in the form of changes to meanders, however these alterations appear to be the result of natural channel migration across the floodplain.

Limited physical restoration is required along this unit to achieve favourable condition. Restoration efforts should focus on removal of redundant in-channel structures including weirs and groynes.

Unit	Site	HMS	HMC	HQA Score	RHQ Class	Impacts	Comments
4	1	180	2	79	2	Intermediate weir	Naturally functioning stretch of river with no obvious modifications except weir. High quality river habitat, although adjacent land use not supportive of overall river health, maize field adjacent to river channel in floodplain. Classic riffle pool sequence & lots of erosion/depositional features. Good tree cover with lots of fallen trees and large woody debris in channel.
	2	80	2	55	2	Minor ford & cattle poaching	Naturally functioning stretch of river with lots of erosional and depositional features, some cattle

							poaching. Minimal amount of Himalayan balsam, controlled by grazing. Standing dead wood and debris dams. Tree cover along entire reach.
	3	0	1	76	1	None	Highly natural channel, no obvious physical modification. Reach displaying classic riffle pool sequence, wide variety of channel substrates including pebbles, bedrock & boulders. Fairly low intensity land use - cattle grazing, electric fenced to stop cattle access.
	4	0	1	63	1	None	High quality stretch of river habitat displaying lots of natural features - bars, pools, riffles, LWD, debris dams. Low intensity adjacent land management. Key impacts from INNS - HB & signal crayfish.

River Lugg RHS Surveys 2025 (Unit 4)

Figure 29. RHS Site 1, HMC = 2. Naturally functioning section of River, intermediate weir reduces overall HMC. Maize field in adjacent floodplain with limited riparian buffer.

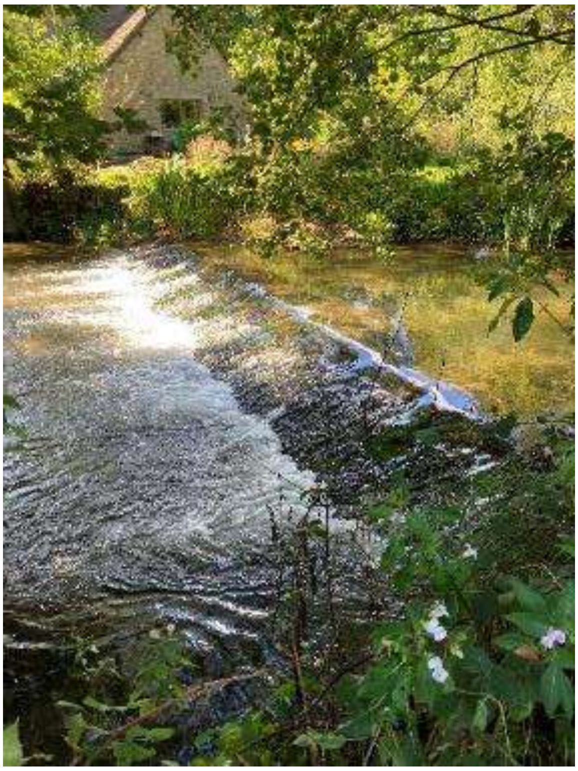

Figure 30. RHS Site 3, HMC = 2. Score impacted by minor ford and poaching. Adjacent habitat low intensity cattle grazing.

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Figure 32. RHS Site 3, HMC = 1. Pristine reach, floodplain land use low intensity cattle grazing and broadleaf woodland. Otter signs present.

Figure 31. RHS Site 4, HMC = 1. Natural reach of river with fallen trees. Extensive Himalayan balsam on right bank.

Unit 3

Planform: Pass
Habitat Modification: Fail (in channel structures)

Unit 3 from Aymenstry to just downstream of the River Lugg Meanders SSSI near Eyton is predominantly physically unmodified, with a natural planform and a well-connected floodplain. Physical modifications include weirs and set back flood embankments. Silt was recorded as a significant pressure in this unit & signal crayfish prescence was also recorded extensively.

Planform analysis through comparison with historic maps map (OS 1830 – 1880's county layers) indicates the channel planform has not been altered during the last ~200 years. The channel follows a similar sinuous meandering course & in along a couple of reaches the sinuosity has increased since the 1830's (i.e. SO4647661308). Historic mill leats have also been lost during this time. Where alterations to the planform have occurred, the alterations appear to be the result of natural channel migration across the floodplain.

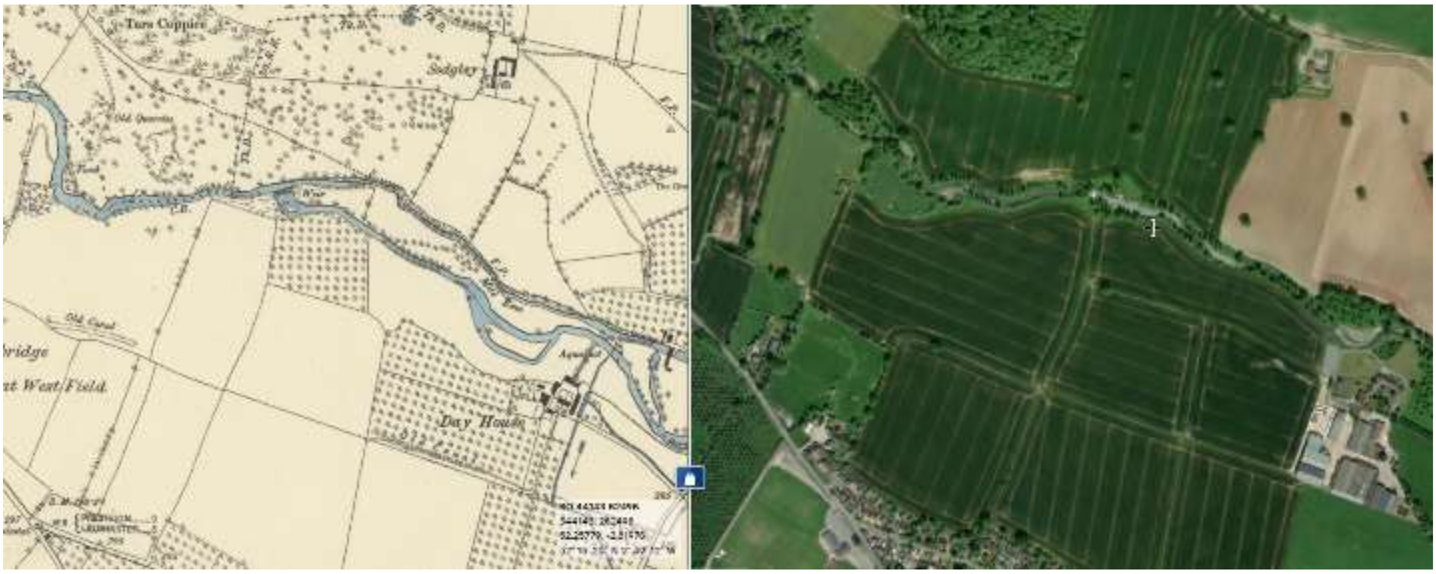
Similarly to Unit 4, limited physical restoration is required to achieve favourable physical habitat condition along this unit. Physical river restoration should focus on the removal of redundant in channel structures.

It should be noted that a significant enforcement event occurred along Unit 3 during December 2020. 1.5km of the river was dredged and riparian woodland was felled. The enforcement was subject to an in-depth investigation, which has not been included within this assessment. There is an ongoing restoration order to restore the damage.

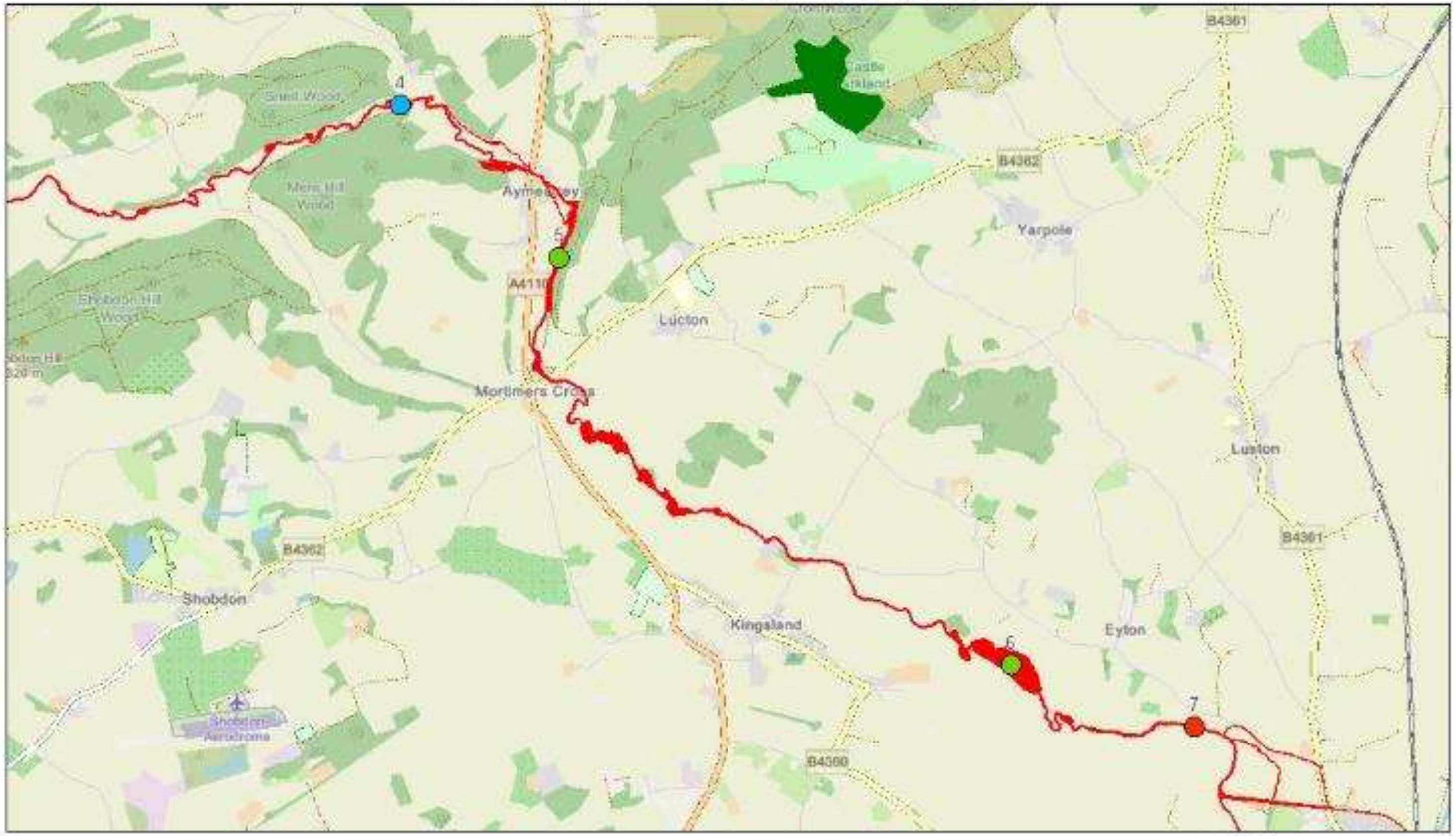
Unit	Site	HMS	HMC	HQA Score	RHQ Class	Impacts	Comments
3	5	30	2	61	2	Collapsed weir acting as a major groyne	Overlying silt along whole stretch & collapsed weir recorded as major groyne.. Diatom cover also recorded along entire stetch.
	6	50	2	52	2	Fence posts in channel	Natural channel with no obvious physical modifications and erosional/depositional features. Signal crayfish present and silt and diatoms overlying the whole stretch.

Figure 33. Comparison Historic Map (OS 1830 – 1880 country layer) to ESRI World Imagery 2026. Note development of meanders in right hand image (2026).

Figure 34. Comparison Historic Map (OS 1830 – 1880 country layer) to ESRI World Imagery 2026. Note loss of mill leat.



River Lugg RHS Surveys 2025 (Unit 3)



27/01/2026

River Lugg RHS Map Locations _ 2025 Surveys
- 1
- 2
- 5

Sites of Special Scientific Interest Units (England)
- FAVOURABLE
- UNFAVOURABLE DECLINING

1:72,224

0 0.38 0.75 1.5 mi

0 0.5 1 2 km

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri

Daisy Burns
Natural England

Figure 37. RHS Site 5, HMC = 2. Left bank land use broadleaf woodland, right bank improved grassland and arable.

Figure 36. RHS Site 6. Natural functioning reach of river. Land use semi-improved grassland with patches of broadleaf

Figure 35. RHS Site 5. Broadleaf woodland provides dappled shading along this stretch.

Figure 38. RHS Site 6. Fence posts reduce habitat modification class. Filamentous algae extensive along this reach.

Unit 2

Planform: *Pass
Habitat Modification: Fail

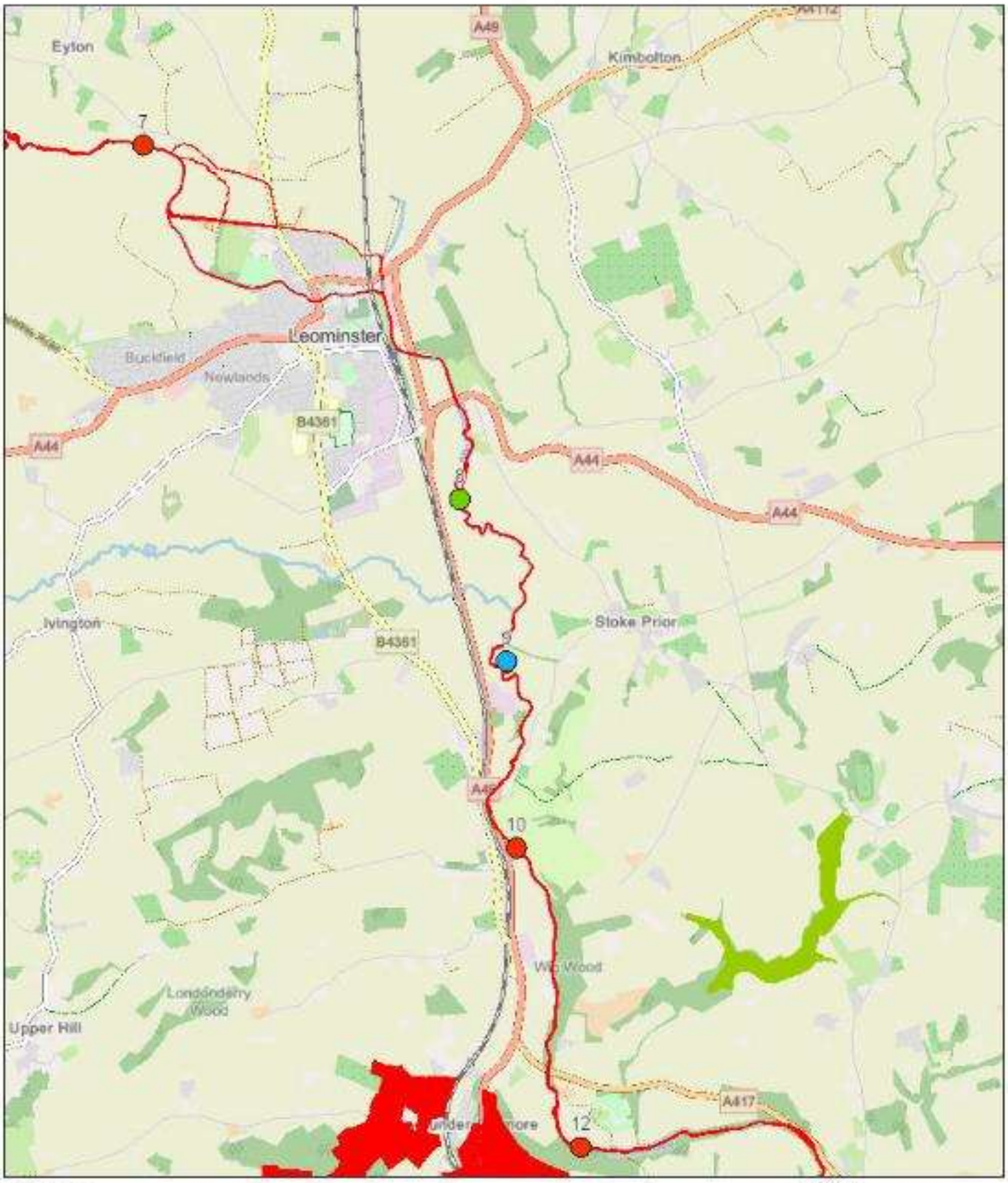
Unit 2 runs from just upstream of Leominster, near Eyton, to Hope under Dinmore. This reach has been extensively modified for flood protection & agricultural improvement. Leominster flood mitigation scheme, which included the creation of a separate flood alleviation channel, has been built through and around the town of Leominster and the river has been embanked and channelised. Upstream of Leominster flood protection works have also taken place to protect agricultural land, including extensive dredging and embankments.

Downstream of Leominster the rivers character changes significantly. Along many reaches the channel is significantly deeper, with extensive sections where downcutting is evident & floodplain connectivity is limited. Determining the influence of historic modification is challenging as alterations to the channel for navigation and flood alleviation occurred over 50+ years ago & a number of reaches are now re-naturalising, evidenced by the development of recovery berms. It is only through the comparison of different reaches & consultation of historic records that the natural character of the river can be determined. Historic records held by the British Library record major channelisation works between the 1930's and 1980's, primarily influenced by Severn Trent Water and Welsh Water Authorities (Jacobs, 2015)

Analysis of the planform through comparison with historic maps map (OS 1830 – 1880's county layers) indicates that the channel planform has not been altered during the last ~200 years, with the exception of the Leominster Flood Alleviation Scheme. The planform has been significantly altered around Leominster. A number of reaches have been recorded as significantly modified due to over deepening. However, the reaches with over deepening have not been associated with significant straightening.

*It is recognised that some aspects of physical modification are 'fixed' due to societal requirements for flood protection. However, there are reaches where floodplain re-connection could be attained. This would require agricultural land use to alter to accommodate flood flows (i.e. arable → floodplain grassland). Whilst technically challenging, full restoration of the river channel and floodplain re-connection should be the objective where flooding does not pose a risk to housing, industry and critical infrastructure.

River Lugg RHS Surveys 2025 (Unit 2)



27/01/2026

1:72,224

0	0.38	0.75		1.5 mi
0	0.5	1		2 km

River Lugg RHS Map Locations _ 2025 Surveys

- 1
- 2
- 5

Sites of Special Scientific Interest Units (England)

- UNFAVOURABLE RECOVERING
- UNFAVOURABLE DECLINING

Map data © OpenStreetMap contributors, Microsoft, Facebook, Google, Esri Community Maps contributors, Map layer by Esri

Daisy Burris
Natural England

Site	HMS	HMC	HQA Score	RHQ Class	Impacts	Comments
7	1520	5	32	5	Embanked & re-sectioned	Extensive historic flood alleviation works undertaken. Both sides of banks were embanked along the entire length, Limited in channel diversity, very uniform, extensive FGA and no in stream plants.
8	40	2	57	2	Pollution, fisheries management, bank mowing & silting	Natural section in terms of physical habitat. FGA extensive across entire reach. Signal crayfish present and stocked with rainbow trout.
9	0	1	41	2	Silting	Channel fairly uniform with limited in channel vegetation. Channel is very deep with very steep banks. Landowner advised no dredging in the past 50 years, however channel appears to be over deepened. HMS score of 1 due to method, however question around whether or not the river should be recorded as re-sectioned/over-deepened. Signal crayfish burrows extensive. Good bankside tree cover and margins. Tree clearance has taken place with some trees retained.
10	2800	5	34	4	Over-deepening, silting	Reach difficult to access due to thick vegetated margins. Water turbid and grey/green colour. Section appeared to have been historically re-sectioned with limited natural features. Map planform indicated sites may have been historically straightened. Where bed visible heavily silted.
12	1600	5	45	5	Over deepening, silting	River running along broadleaf woodland on right bank and intensive grassland on left. Over deepened and appears to have been historically re-sectioned, with limited natural in-channel features. Heavy silting. No in-channel vegetation and extensive FGA. Downstream sectioned heavily over deepened.

Figure 39. Leominster Flood Scheme. Comparison of historic map (OS 1830 – 1880 county layer) to OpenStreetMap 2026. Note significant channel alteration and straightening.

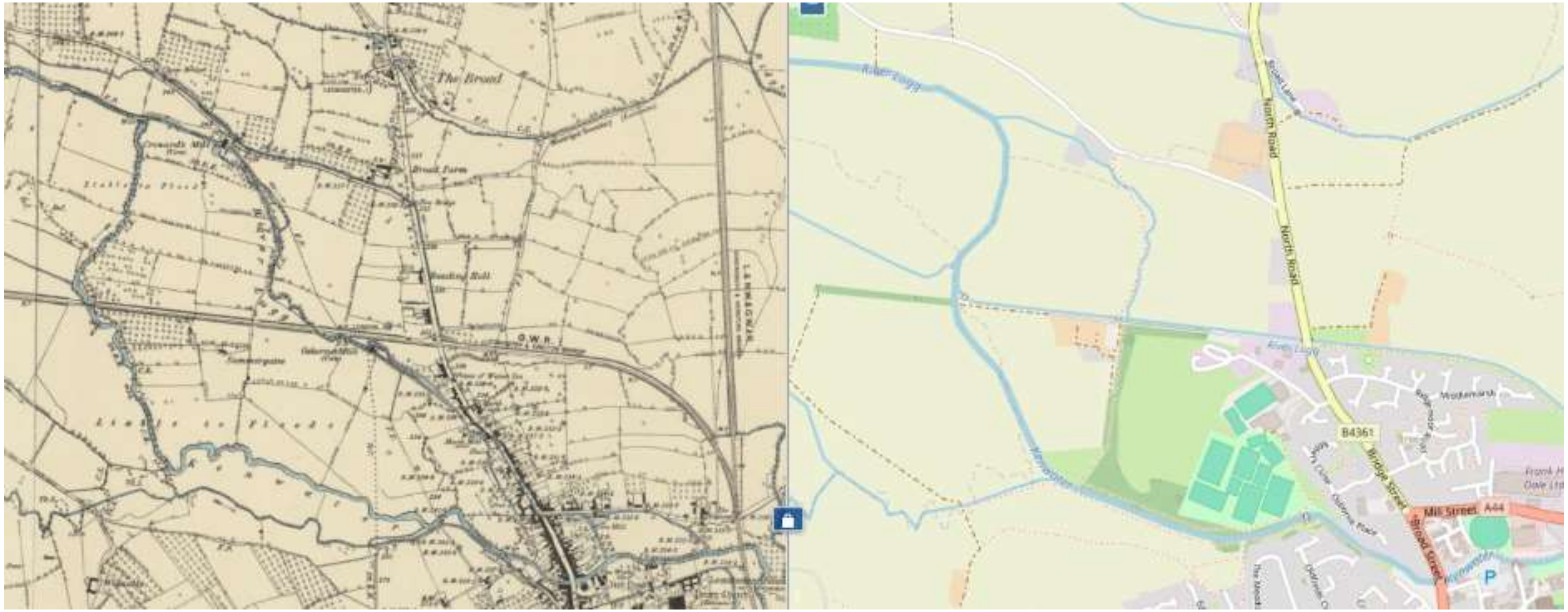


Figure 41. RHS Site 7. Site historically dredged and embanked, extensive FGA.

Figure 40. RHS Site 8. Bank profile and depth more natural in contrast to site 7 upstream (Figure 10).

Figure 43. RHS Site 9. Reach appears over deepened, extensive filamentous algae but some habitat provided by tree features. Banks 3m+.

Figure 42. RHS Site 12. River running along broadleaf woodland, over depended & heavy siltation pressure.

Unit 1

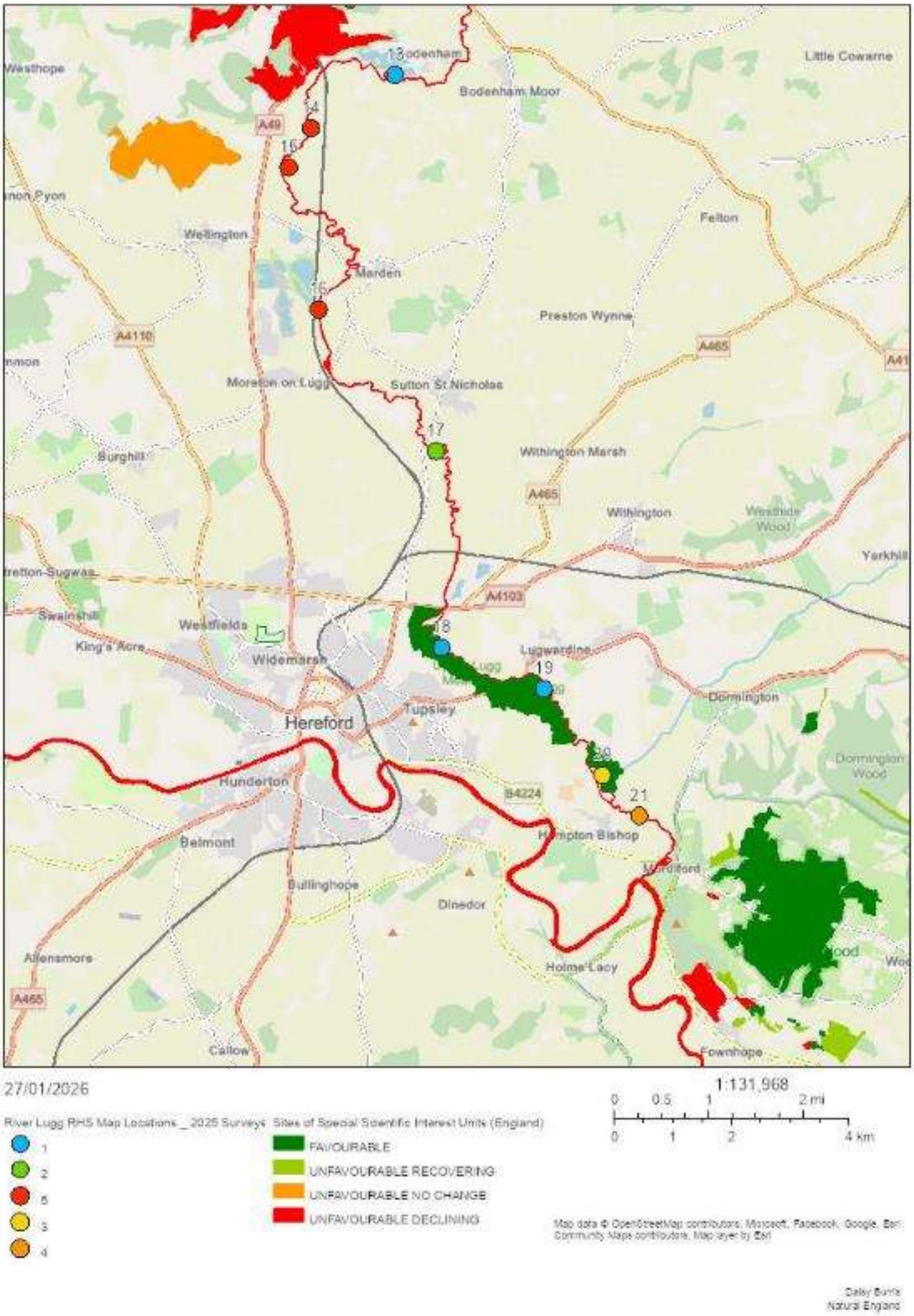
Planform: Pass
Physical Habitat Modification: Fail

The lower section of the River Lugg from Hope under Dinmore to the confluence with the River Wye near Mordiford is highly varied in terms of physical modifications. In the upper section of Unit 1, from Hope under Dinomore to Moreton on Lugg, significant stretches of the river have been historically embanked and over deepened, leading to a loss of functional floodplain connectivity & natural in channel features. Flows along historically dredged reaches are slower due to the greater conveyance capacity resulting in heavy siltation.

Analysis of the planform through comparison with historic maps map (OS 1830 – 1880's county layers) indicates that the channel planform has not been altered during the last ~200 years. A number of reaches have been recorded as significantly modified due to over deepening. However, the reaches with over deepening have not been associated with significant straightening.

The lower section of Unit 1 from Moreton on Lugg was recorded as predominantly natural. The river is connected to the floodplain and extensive areas of unimproved & semi-improved floodplain grassland, including the Lugg & Hampton Meadows SSSI, adjoin the river. Downstream of Lugg & Hamton Meadows, below the River Frome confluence, the river is less natural and has set back embankments, and the reach appears to be over-deepened. During the surveys it was noted that there was a marked reduction in water clarity downstream of the Frome confluence.

River Lugg RHS Surveys 2025 (Unit 1)



Site	HMS	HMC	HQA Score	RHQ Class	Impacts	Comments
13	0	1	43	2	None	Herefordshire Council and HWT. Sensitive management on right hand bank i.e. no inputs but along left-hand bank large crop of potatoes. Very deeply incised and difficult to access due to steep, deep banks, a lot of balsam and dense tree cover. Field corners are essentially the hard to manage bits on inside of meanders on both banks & largely left to grow up and buffer the river. Typical rank ruderal species but providing useful supporting habitat for the river and a whole host of other taxa.
14	3200	5	27	5	Silting, over deepening	Survey severely compromised as river inaccessible along the majority of the length due to dense riparian corridor. River embankments on both sides, channel significantly deepened and floodplain meadows divorces from floodplain. Floodplain meadows connected by drainage channel so not naturally functioning. Significantly impacted by silting, downcutting, steep banks vertical and bare. Large numbers of signal crayfish.
15	2890	5	53	4	Silting, over deepening	Historically over deepened channel, down cutting with very steep banks 3m+ in height. Good tree cover, 100 year + crack willows.
16	2146	5	46	4	Over deepening	Historic realignment / re-sectioning with some naturalisation occurring.
17	92	2	52	2	Silting	No fencing along the reach and signal crayfish extensive. Diversity of characteristics but extensive impacts from grazing are clear, even the mid channel bar was grazed. However, no HB. Whole section not fenced and is pretty bare of cover, plenty of bank poaching especially on the bars and berms but no Impatiens seen throughout whole RHS reach. Massive (long) embankment (between 1m and 1.5m in height) set back some way from river on both banks. Tenant farmer with huge pump abstracting water until recently told not to due to low river levels.
18	10	1	63	1	None	Righthand bank is Lugg Meadows SSSI, in theory sensitively managed but anecdotally the snake's-head fritillary is declining. This species is dependent on a strict hydrological regime of winter inundation so the Open University's Floodplain Meadows Partnership will have been monitoring the species and may have very valuable insight to how flood patterns may have changed.

19	0	1	69	1	None	Site possibly historic re-sectioning but re-naturalised.
20	380	3	58	3	Major bridge	Dynamic section of river with classic riffle pool run sequence, various flow types and fairly clean gravels. Water crowfoot beds and some woody material in the channel with good tree cover. However, water clarity along this reach is poor and suggests a sedimentation issue. HMC score impacted by presence of major bridge, but otherwise naturally functioning stretch of river.
21	912	4	45	4	Silting, over deepening	Section difficult to interpret & was in marked contrast to site 20 (700m upstream). Lower reach appeared significantly over deepened, uniform flows and very sluggish. However further upstream the channel became more dynamic with riffle/pool features. Site embanked and disconnected from the floodplain. Water quality very poor and question over influence from River Frome which enters just upstream. Large field / highways drains entering site. Heavy siltation impact.

Figure 45. RHS Site 13. HMC = 1. Site relatively unmodified though the left bank is somewhat high and the river width appears to be wide

Figure 44. RHS Site 14. HMC = 5. Significantly over deepened & disconnected from floodplain.

Figure 47. RHS site 17. HMC = 2. Note poaching from livestock.

Figure 46. RHS Site 18. HMC =1 Relatively unmodified stretch of river

Figure 49. RHS Site 20. HMC = 3. Site score impacted by major bridge.

Figure 48. RHS Site 21. HMC = 4. Site over deepened, embanked and heavily silted. Some positive habitat features formed by trees, including submerged tree roots

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Riparian Zone Vegetation Naturalness

Land use is one of the key driving factors which influences the ecological condition of rivers. Sediment transport, nutrient and chemical loading and natural hydrological function are all regulated by catchment land use.

Semi-natural habitats, such as woodlands, wetlands and grasslands, play a vital role in supporting river health. They act as buffers that filter sediments, nutrients, and pollutants before they enter rivers, improving water quality. Their vegetation stabilises banks, reduces erosion, and slows surface runoff, helping to maintain natural flow regimes.

Semi-natural habitats provide shade, regulate water temperature, and contribute organic matter that supports aquatic food webs. By sustaining diverse plant and animal communities, they enhance connectivity between terrestrial and aquatic ecosystems, increase resilience to flooding and drought, and maintain the ecological processes essential for healthy river functioning.

Method

The riparian vegetation naturalness is assessed via analysing the results of the RHS data: Section F 'Bank top & Land use & Vegetation Structure' & section H 'Land-use withing 50m of Bank top'. The results from the RHS forms are input into '[Data analysis template – Riparian Zone Naturalness]'.

SERCON scores are generated for each RHS site (System for Evaluating Rivers for Conservation). The different RHS Land Use categories are assigned points (Table 18). The SERCON score is generated from these points. Habitats and land use types with a higher degree of naturalness such as woodland or wetland score more highly. Artificial habitats such as improved grassland have a lower score. Refer to River CSM for further information on analysing riparian naturalness (JNCC, 2016).

Aerial imagery including CEH Land Use cover maps and the priority habitat inventory were further analysed to assess land use in the wider landscape. Land use results are detailed in the Tables below. Maps of land use cover are located in Appendix 2.

Table 18 RHS Land use categories and points

RHS Land Use Categories	Points
Broadleaf/mixed woodland	4
Broadleaf/mixed plantation	1
Coniferous woodland	4
Coniferous plantation	0
Scrub and shrubs	3
Orchard	1
Wetland (e.g. bog, marsh, fen)	4
Moorland/heath	4

Artificial open water	1
Natural open water	3
Rough/unimproved grassland/pasture	3
Improved/semi-improved grassland	1
Tall herb/rank vegetation	2
Rock, scree or sand dunes	4
Suburban/urban development	0
Tilled land	0
Irrigated land	0
Parkland or gardens	0

Site Objectives

Across the site bank and riparian zone vegetation structure should be near-natural. The riparian zone vegetation target is a mean score for the assessment unit of 4 or 5.

General Catchment Land Use

Land use in the Lugg catchment is dominated by arable agriculture and improved pasture. Arable farming immediately adjacent to the river is extensive. The 2010 DEFRA Agricultural census data recorded Root Crops occupying 62% of arable land, Mixed as 15% and Horticulture as 22% of arable farmed land. In terms of livestock farming, 17% of farms are recorded as upland grazing whilst 83% are recorded as lowland grazing.

The majority of the River Lugg is tree lined and features including overhanging boughs and underwater tree roots were recorded extensively along the majority of reaches surveyed. The RHS surveys recorded semi-continuous – continuous tree extent along the river corridor in 85% of survey reaches. Only a single reach (5%) recorded tree cover as ‘Isolated scattered’. However, much of this semi-continuous tree cover is just a single line of trees deep which means that the trees are vulnerable to falling in if the channel naturally moves. In the case of Alder, they are also vulnerable to disease, such as Phytopthera, which can kill trees and leave them vulnerable to falling. While the addition of coarse woody material to the river is desirable the potential to lose many trees at once is not as it could leave stretches of river unshaded and cause accelerated bank erosion.

Limited semi-natural habitats remain along the River Lugg riparian corridor. Discrete blocks of woodland and unimproved floodplain grassland persist along isolated reaches. No floodplain marsh/wetland or wet woodland habitat was recorded during the surveys which reflects the loss of these important habitats and the vulnerability of the river and it’s species

Unit 4

Target Compliance: Fail*

Land use from Presteigne to Aymestry is dominated by improved / semi-improved grassland and arable farming along the riparian corridor. The RHS sites surveyed passed for the riparian land use assessment (Table 19). Land use along significant stretches of the unit is assessed as supporting the overall river health and function.

*However, aerial analysis of land use along the whole unit highlights significant stretches of arable cropping adjacent to and along the floodplain (Figure 50 & 51). Arable cropping adjacent to the river is a high-risk activity and creates a significant source of sediment and nutrient loading to the river. At a whole unit scale, land use is assessed as unfavourable to support favourable condition of the site. Targeted uptake of environmental schemes which enable the conversion of arable to low intensity grazing or alternative semi-natural habitats in the floodplain is a key requirement to achieve favourable condition.

Table 19. Riparian Land Use Sercon Scores Unit 4.

Unit	RHS site	Score	Unit Score	Pass (Yes/No)
4	1	5	4.25	Yes
	2	5		
	3	5		
	4	2		

Table 20. Summary Land Use Results Unit 4 - RHS Sites.

Unit	Site Ref	Predominant Land Use	Tree Extent	General land use
4	1	Broadleaf woodland & arable	Semi-continuous - continuous	Land use along this reach is mixed. The river is tree lined along this reach. On the right-hand bank there is a large arable maize field adjacent to the river. Along the majority of the left-hand bank the floodplain is broadleaf woodland.
	2	Broadleaf woodland & improved grassland	Semi-continuous - continuous	Land use along this reach is mixed, dominated by low intensity cattle grazing & improved grassland. Trees line the majority of the river corridor with a patch of woodland along the righthand bank on the downstream reach.
	3	Broadleaf woodland and semi-improved grassland	Semi-continuous - continuous	Land use along this reach is dominated by low intensity cattle grazing with sections of broadleaf woodland
	4	Broadleaf woodland and semi-improved grassland	Semi-continuous - continuous	Land use along this reach is predominantly low intensity sheep pasture, not species rich. River reach tree lined.

Figure 50. River Lugg Unit 4 Aerial Map

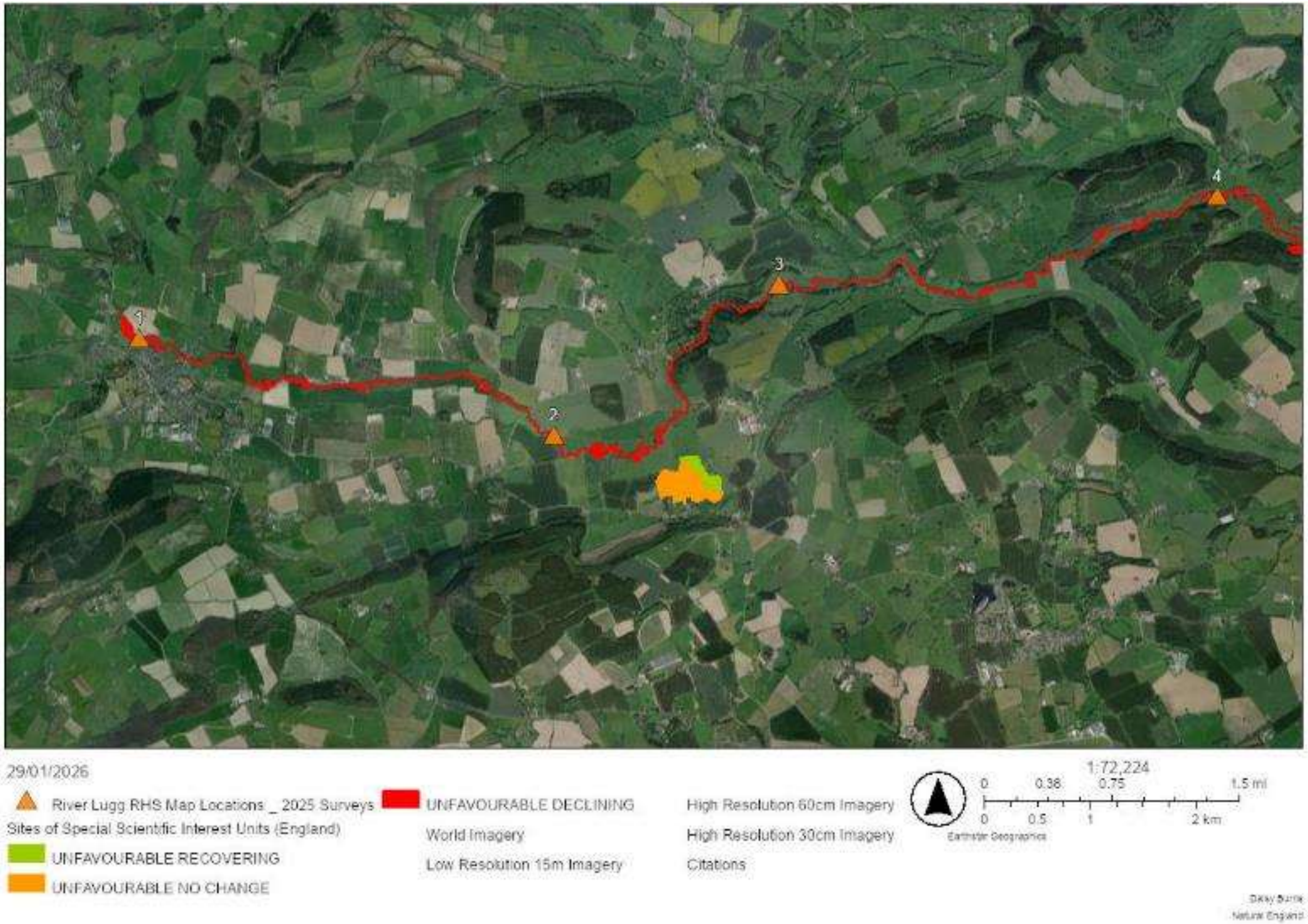
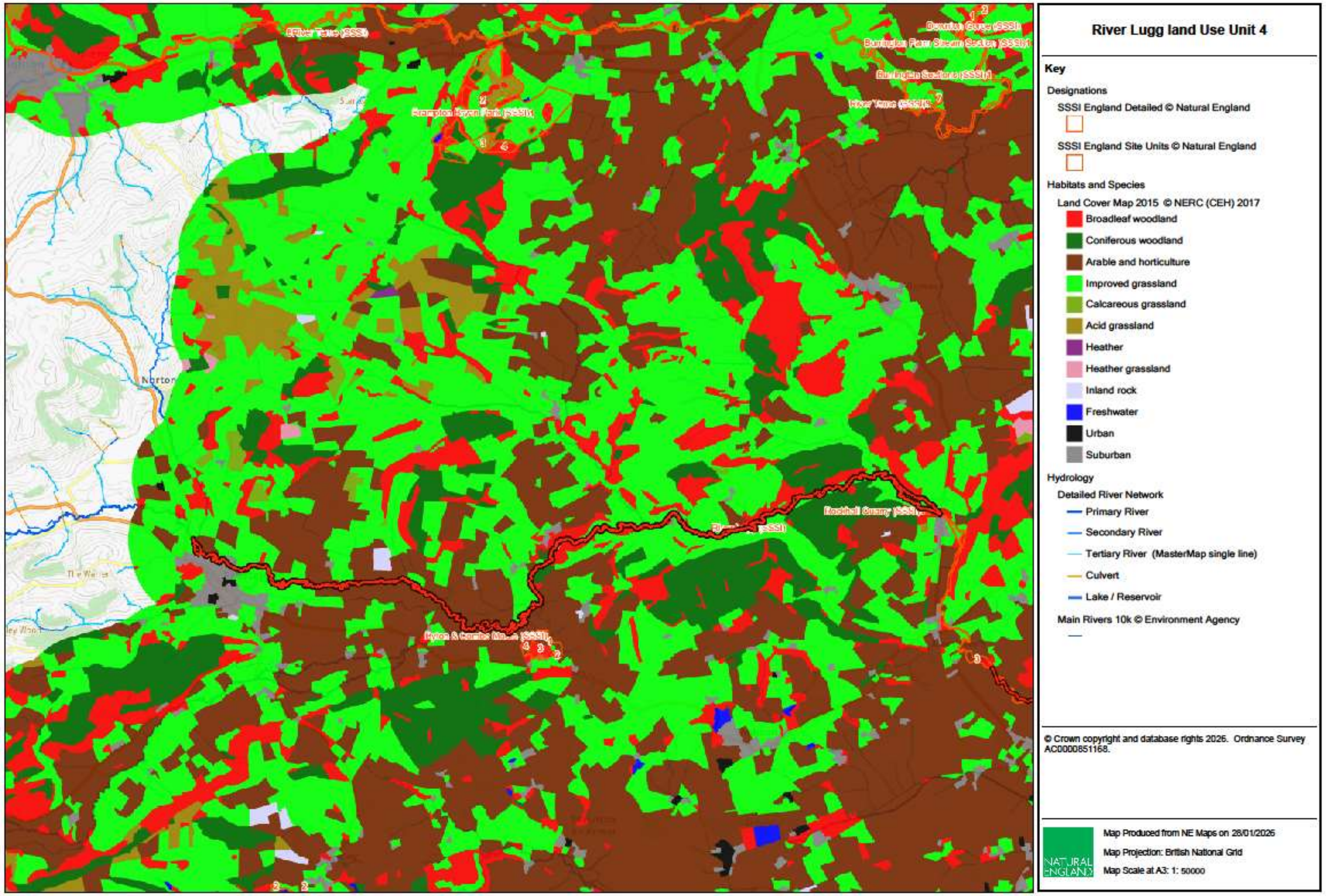


Figure 51. CEH Land Use Cover Map (2015) River Lugg Unit 4



Unit 3

Land use from Aymestry to Eyton is dominated by arable farming along the riparian corridor (Figure 52 & 53). The RHS surveys recorded significantly more pressure from siltation in along this unit, which may correlate with the increase in arable farming along the floodplain. Arable cropping adjacent to the river is a high-risk activity, especially in sloping land and reversion to low intensity farmland and semi-natural habitats is required across the unit to achieve favourable condition. Similar to Unit 4 & 3, targeted uptake of environmental schemes which enable the conversion of arable to low intensity grazing or alternative semi-natural habitats in the floodplain is a key requirement to achieve favourable condition.

Unit	RHS site numbers	Score	Unit Score	Pass (Yes/No)
3	5	5	3.5	No
	6	2		

3	5	Broadleaf woodland, improved grassland & arable,	Semi-continuous - continuous	Land use along this reach is mixed. The left bank is dominated by broadleaf woodland along the entire reach. Along the right-hand bank, the reach is tree lined but in the wider floodplain land use is dominated by improved grassland and arable agriculture.
	6	Semi-improved grassland	Occasional clumps - semi-continuous	Land use predominantly semi-improved grassland with clumps of broadleaf woodland.

Figure 52. River Lugg Unit 3 land Use – Aerial Map

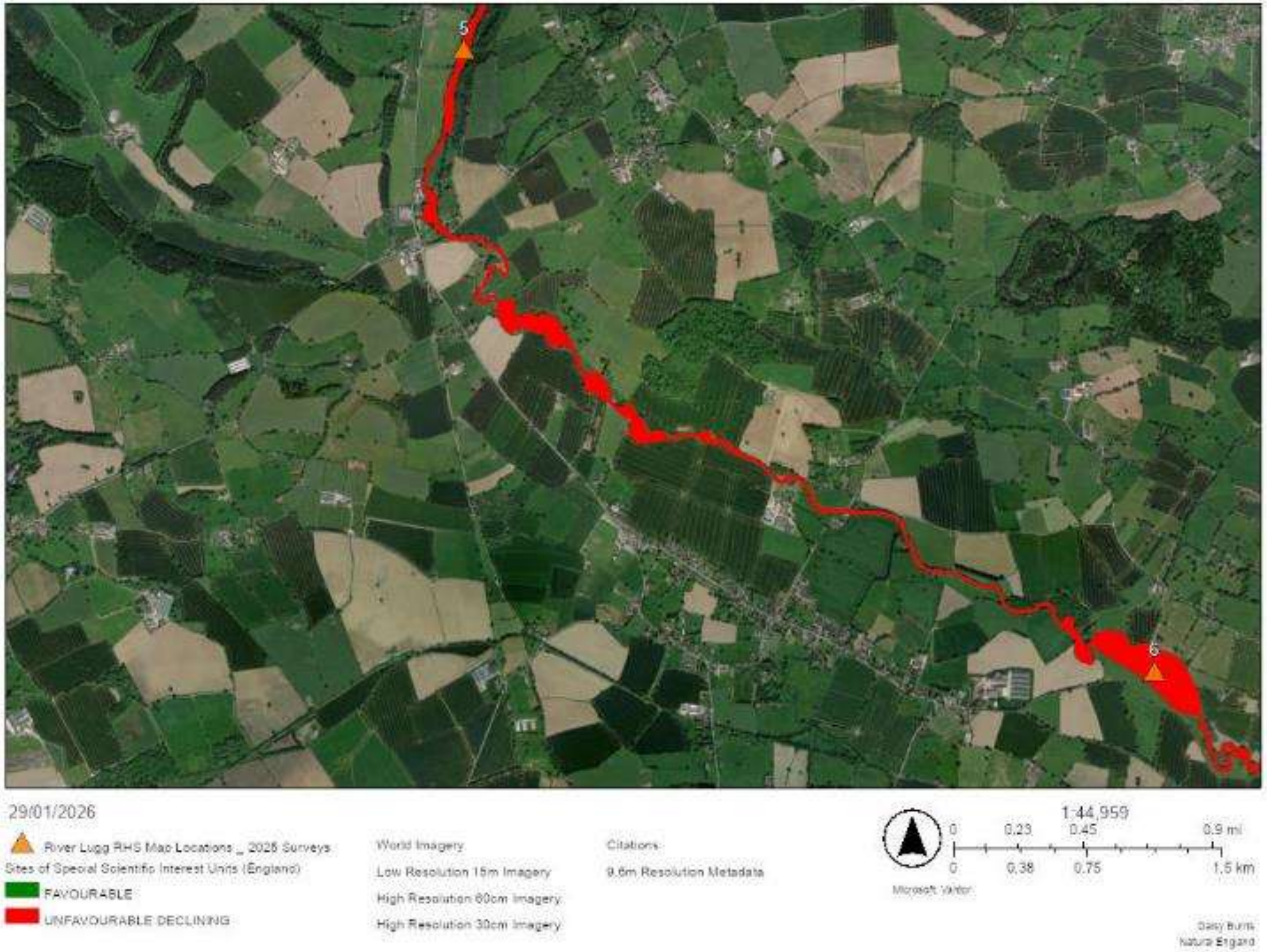
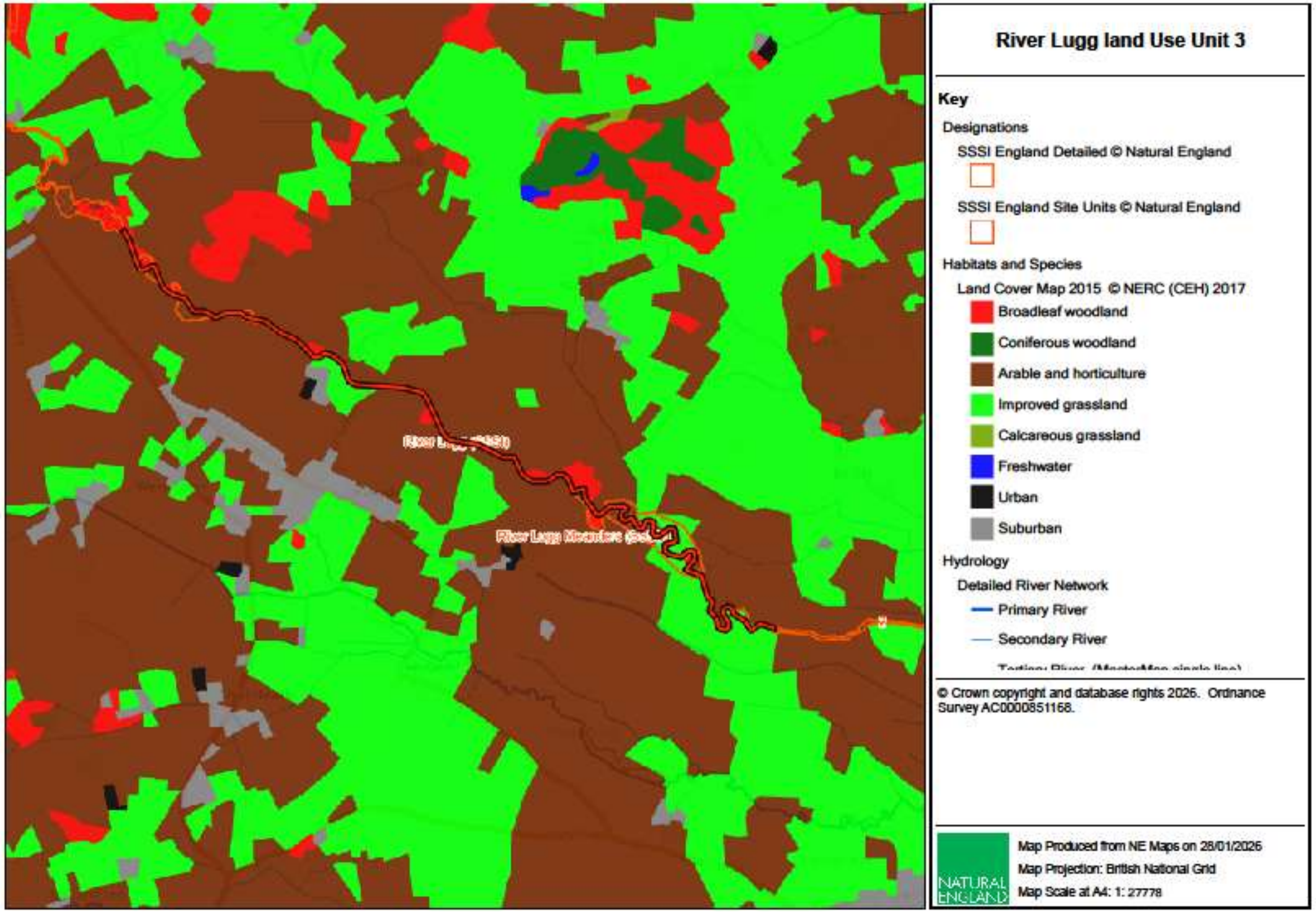


Figure 53. CEH Land Use Cover Map (2015) River Lugg Unit 3



Unit 2

Land Use from Eyton to Hope Under Dinmore is dominated improved grassland, arable farming, hard infrastructure (Leominster town) & Leominster Golf course. Current land use is not conducive to supporting a naturally functioning river system. Sections of semi-natural habitat including Wig Wood & Ashen Grove provide valuable tree cover & biodiversity benefit along this reach. Significant land use change along the riparian corridor is required to reach favourable condition.

Unit	RHS site numbers	Score	Unit Score	Pass (Yes/No)
2	7	2	2.6	No
	8	1		
	9	5		
	10	0		
	12	5		

Site Ref	Predominant Land Use	Tree Extent	General land use
7	Improved grassland	Semi-continuous - continuous	Land use along this reach is improved cattle pasture & arable
8	Improved grassland	Occasional clumps	Land use along this reach is dominated by improved grassland with tall ruderal vegetation.
9	Poor semi-improved grassland / improved grassland	Semi-continuous	Right bank arable reversion 30+ years ago, original EN conservation scheme, low intervention, no fertilizer, mainly cutting for hay. Low species diversity but recovering, left bank was not surveyed, aerial imagery suggests improved grassland. Arable dominant in wider landscape.
10	Parks and gardens / tilled land	Semi-continuous	Right hand bank golf course adjacent to river with thick vegetated margin (tall herbs/scrub) and tree lined. Right hand bank dominated by tilled land, also with a scrubby margin.
12	Broadleaf woodland & improved grassland	Continuous (Left), semi-continues (right)	Broadleaf woodland along right bank (steep), improved grassland along left bank

Figure 54. River Lugg Unit 2 land Use – Aerial Map

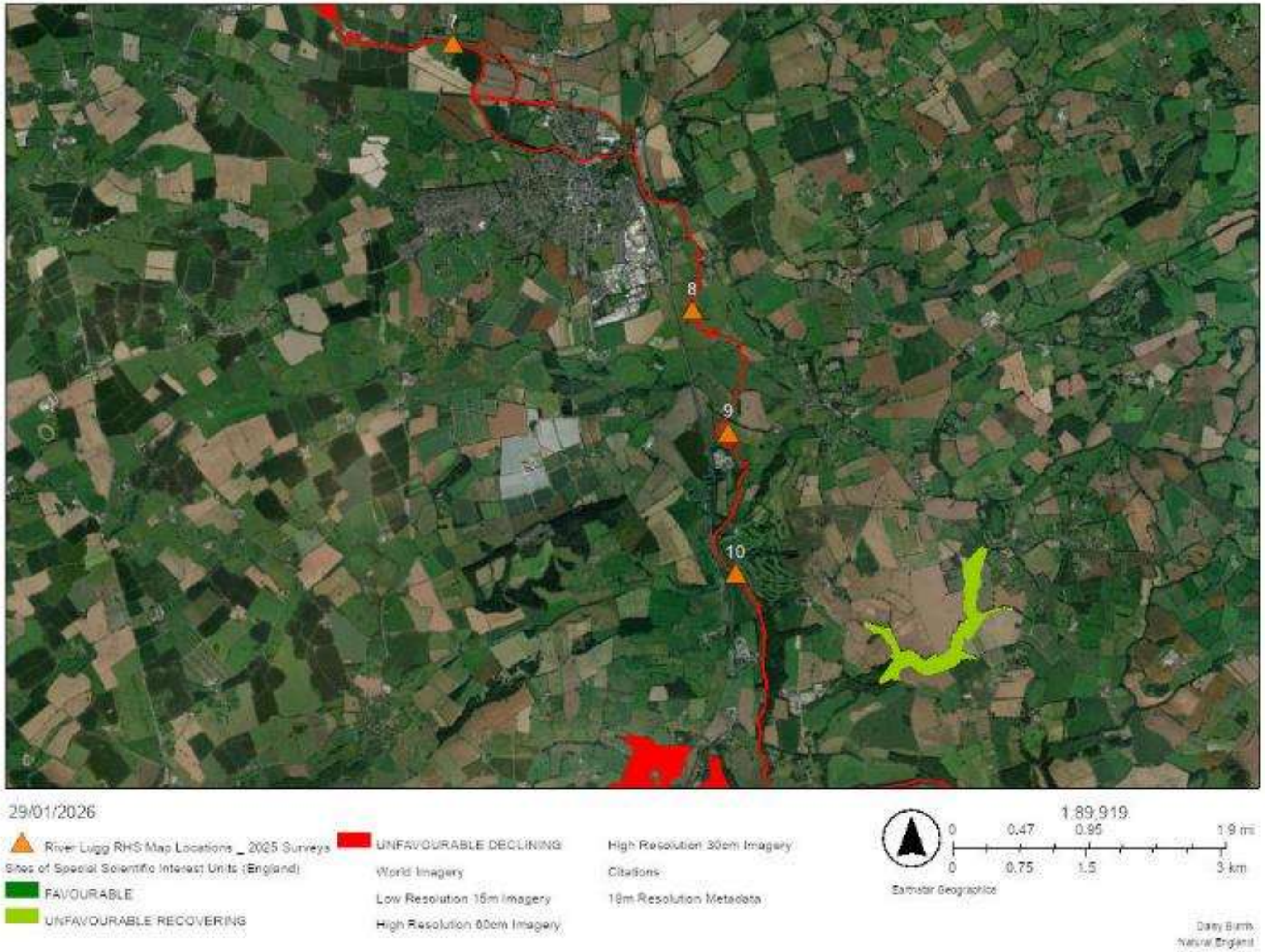
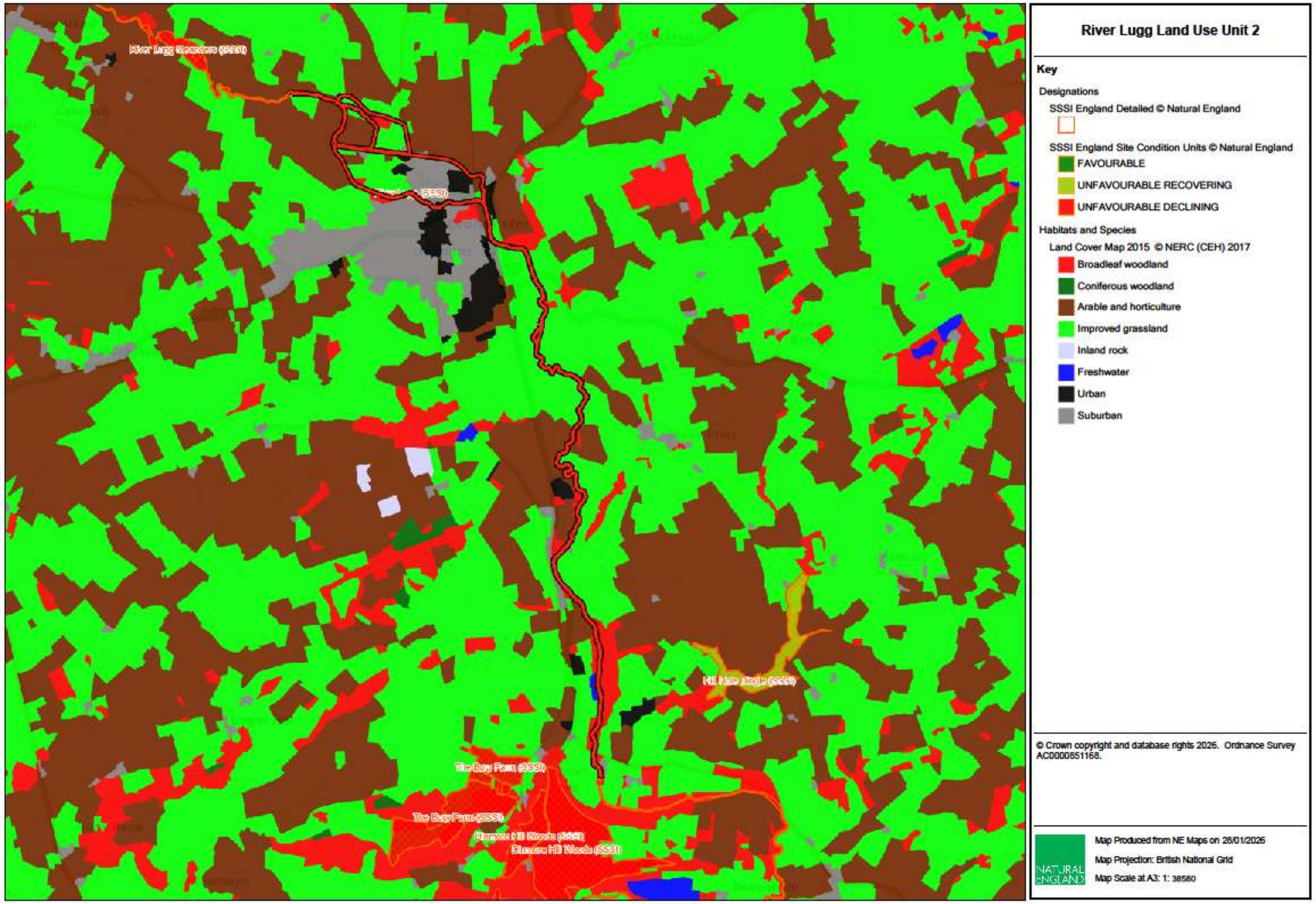


Figure 55. CEH Land Use Cover Map (2015) River Lugg Unit 2



Unit 1

Land use along the Lower Lugg from Hope under Dinmore to the confluence with the River Wye near Mortimers Cross is variable. In the upper reaches of the unit the floodplain is dominated by arable farming. Towards the lower end of the unit land use is dominated by improved and semi-improved grassland Three out of nine of the RHS sections recorded land use as ‘semi-natural’ and supporting the river health and function, the reaches included areas where Lugg and Hampton Meadows SSSI adjoined the site, which is notified for lowland neutral grassland

Significant land use change along the riparian corridor is required to reach favourable condition. Arable reversion to floodplain meadows should be encouraged to create a joined-up network of semi-natural floodplain habitats along the lower reaches of the River Lugg. Opportunities for increased tree planting to create alluvial floodplain woodland would create a nationally rare habitat of high conservation value.

Unit	RHS site numbers	Score	Unit Score	Pass (Yes/No)
1	13	1	2.2	No
	14	2		
	15	0		
	16	0		
	17	1		
	18	5		
	19	5		
	20	5		
	21	1		

Site Ref	Predominant Land Use	Tree Extent	General land use
13	Tall ruderal vegetation & semi-improved grassland	Continuous	Semi-improved grassland with tall ruderal vegetation along the riparian margins, wider landscape dominated by arable agriculture & artificial lake to the north of the site.
14	Arable, tall ruderal vegetation and rough pasture	Occasional clumps	Both banks were lined with tall thick ruderal vegetation with occasional clumps of trees. In the wider floodplain arable agriculture was the predominant land use on the left bank, whilst the right bank was semi-improved floodplain meadow.
15	Arable & tall ruderal vegetation	Occasional clumps - Semi-continuous	Both banks were tree lined with a thick margin of ruderal vegetation. Arable land use dominated the floodplain and wider riparian land use.
16	Improved grassland & arable	Occasional clumps - Semi-continuous	Land use dominated by improved grassland and arable with tall herb/scrub shrub riparian vegetation along the riverbed bank top.
17	Improved grassland	Isolated scattered	Improved grassland along both banks, heavy cattle poaching and sward grazed tightly.
18	Unimproved/good semi-improved grassland & Broad leaf woodland	Semi-continuous	Along lefthand bank the riparian corridor is dominated by a block of broadleaf woodland. The right-hand bank the Lugg and Hampton Meadows SSSI - low intensity/ unimproved grassland.
19	Unimproved/good semi-improved grassland & Broad leaf woodland	Continuous - semi-continuous	Along left-hand bank the riparian corridor is dominated by a block of broadleaf woodland and improved grassland. The right-hand bank the Lugg and Hampton Meadows SSSI - low intensity/ unimproved grassland.
20	Poor semi-improved grassland	Semi-continuous - occasional clumps	Site flows through Lugg & Hampton Meadows SSSI, adjacent land had extensive thistles and nettles which may be indicative of nutrient enrichment. Limited species diversity, cattle grazed with lots of poaching.
21	Improved grassland	Semi-continuous - occasional clumps	Site flows through fields of improved grassland on either side. However, set back flood embankments limit floodplain connectivity. Riparian buffer of trees and scrub/shrubs, with lots of bare ground in the understory. Large field drains entering site.

Figure 56. River Lugg Unit 1 land Use – Aerial Map

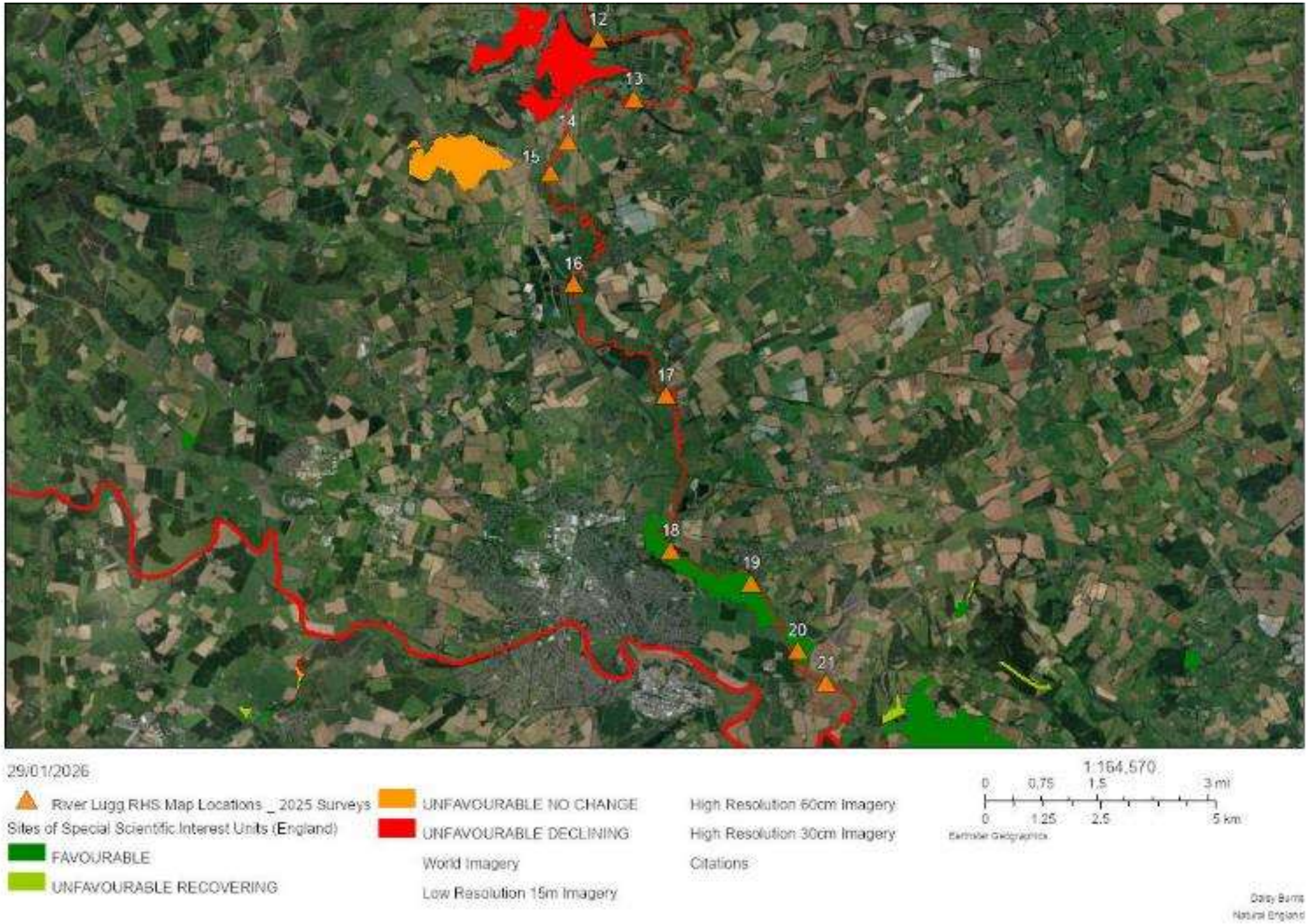
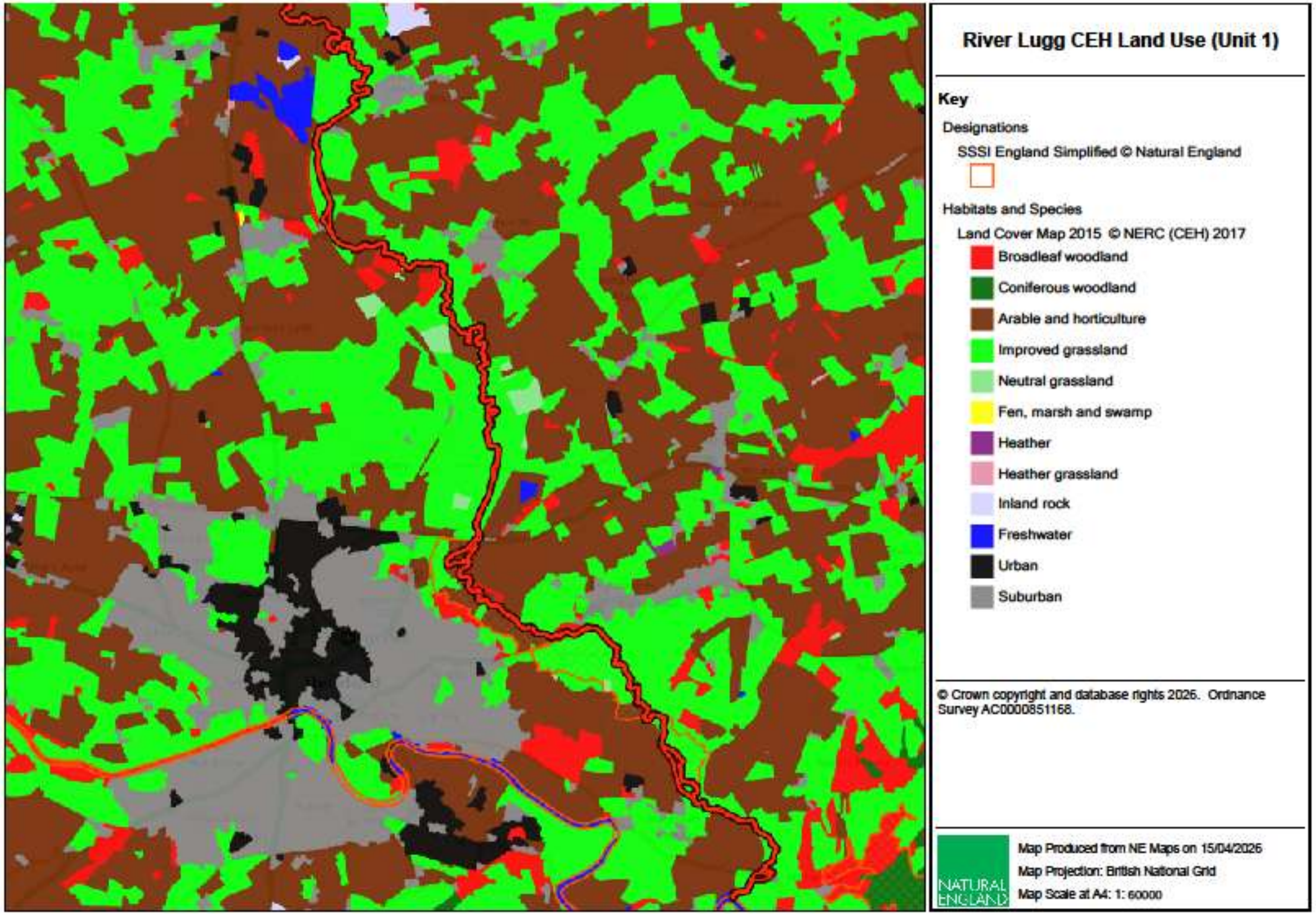


Figure 57. CEH Land Use Cover Map (2015) River Lugg Unit 1.



Large Woody Debris

Large woody debris (LWD) plays a crucial role in maintaining healthy river ecosystems. It creates hydraulic complexity, forming pools and varied flow patterns that enhance habitat diversity for fish and invertebrates. LWD stabilises riverbanks, traps sediments, and supports channel stability. It also provides shelter and spawning sites for aquatic species while helping to connect rivers with their floodplains.

In natural systems, fallen trees and branches are key to creating varied ecological niches, controlling bank erosion, and increasing resilience to floods and droughts. Large woody debris is an essential component of river habitat structure and a key tool for restoration efforts.

Method

Data on large woody debris are available from the 'sweep-up' section of the River Habitat Survey form (Section J – 'Extent of trees and associated features'), recorded as 'absent', 'present' (>0-33% of bank length) or 'extensive' (>33% of bank length).

Condition assessment

Target: Within each assessment unit: EITHER 75% or more RHS sites have large woody debris 'Present' OR 10% or more of RHS sites have large woody debris 'Extensive'

Feature Target Compliance: Pass

The River Lugg is continuously - semi-continuously tree lined along the majority of its length. Tree features including overhanging boughs and exposed and underwater roots were recorded extensively across the site. Large woody debris was recorded as present along 90% of survey reaches. However, only a single reach recorded LWD as extensive (5%). The Upper Lugg (Unit 4) recorded the greatest occurrence of LWD, especially though reaches flowing through alluvial woodland (Fig 54 & 55).

Many of the trees along the bank of the Lugg are single aged. Increasing the woodland cover along the Lugg, with a mix of broadleaf species, would ensure that a continued supply of woody debris resource is available into the future.

Opportunities to hinge whole trees into the river channel, whilst keeping the root plate intact, could increase the habitat heterogeneity, create more varied flows, trap sediment and dissipate flood flows. This could also be used as an effective tool to help restore floodplain interaction along over deepened reaches. The use of woody debris should be targeted to limit worsening sediment deposition in already over-deepened & incised sluggish reaches. Refer to Appendix 2 for results for each section.

Figure 59. RHS Site 3. Woody debris log dam which has created a mid-channel bar. The mid channel bar had extensive evidence of otter feeding.

Figure 58. RHS Site 4. Tree roots bind the bank and also create refugia sites for fish to hide from predators, stay cool in summer and rest during the daytime during upstream migration.

In-channel Structures

Major in-channel structures such as weirs, dams, and culverts significantly alter river hydrology, sediment transport, and connectivity. They disrupt natural flow regimes, reduce habitat diversity, and fragment aquatic ecosystems by blocking fish migration and limiting species dispersal. Impounded sections often experience reduced oxygen levels, increased sedimentation, and altered temperature profiles, which can degrade water quality and favour generalist species over sensitive ones. Downstream, changes in flow and sediment supply can cause channel incision and habitat loss. Overall, these structures reduce ecological integrity, impair natural processes, and diminish the resilience and biodiversity of riverine ecosystems.

Method

The following is a high-level overview of in-channel features and their impact on the river habitat. Data sources used to inform this assessment include the RHS surveys, aerial imagery and the Lugg Weir Report.

Investigations have previously been undertaken to assess in-channel structures and their impact on the ecology of the River Lugg. These assessments have already undertaken surveys of the structures along the river. For a comprehensive account of all in-channel structures refer to the following reports:

- Lugg Weir Report
- River Lugg Technical Report - Geomorphological Survey
- River Lugg River Restoration Plan

Condition assessment

Target: Throughout the assessment unit: if present, structures should have no effect (or minor effect) on fish migration, on sediment transport, and habitat structure. Assessments should include the upstream ‘ponding’ effects that artificial structures have on flow patterns and habitat structure.

Feature Target Compliance: **FAIL**

The Environment Agency undertook an assessment of priority weirs along the Lugg in 2012 and in total assessed 28 weirs. The report assessed the ecological constraints of the weirs along with an analysis of sediment and fluvial dynamics. It is recognised that the prescence of weirs along the Lugg pose a significant constrain to the passage of fauna, along with altering natural sediment and flow dynamics. Out of the 28 weirs assessed, 22 were nominated for further investigation and amendment.

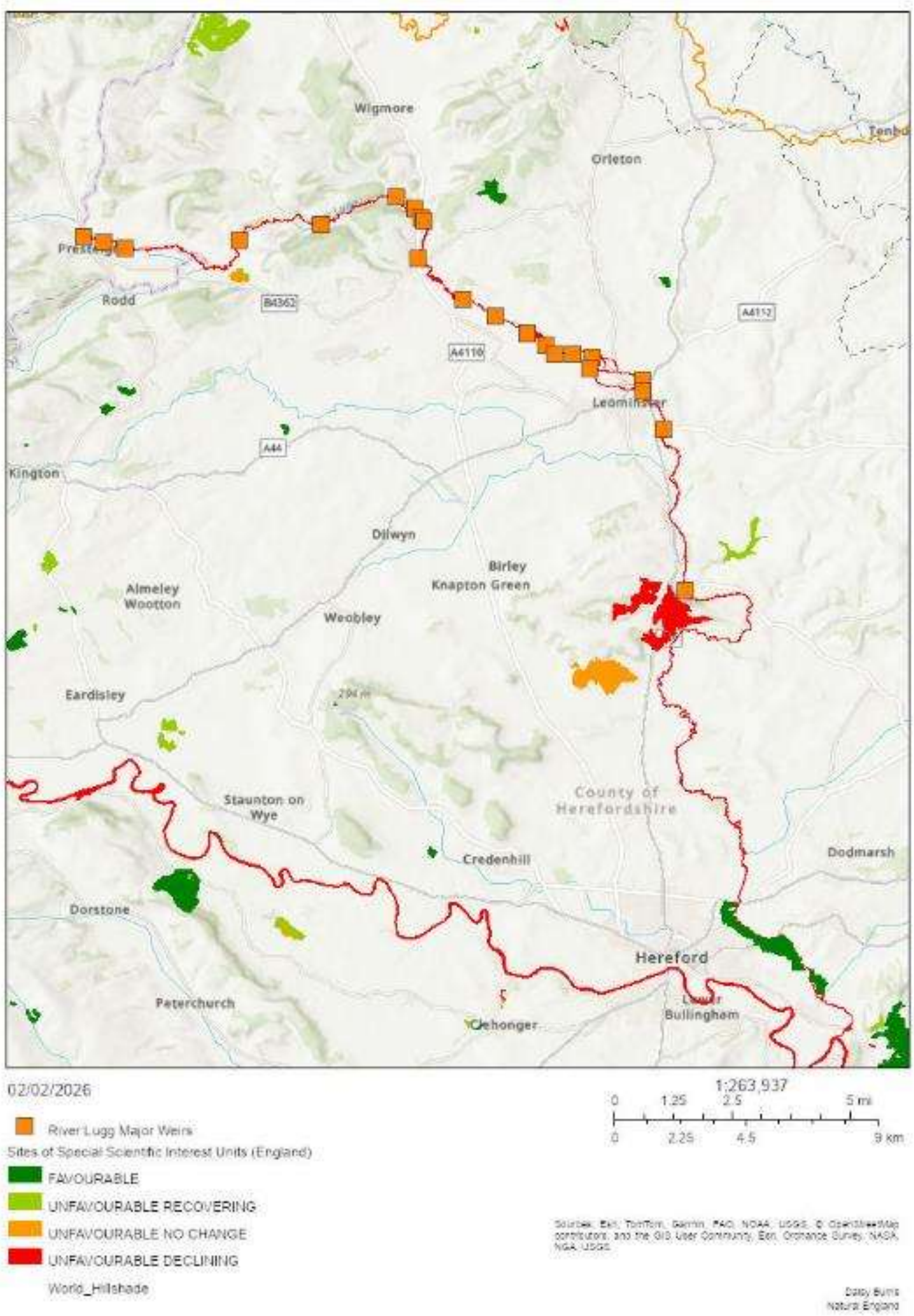
Throughout the Lugg catchment multiple weirs constrain the passage of fish, alter sediment transport and impact the natural habitat & hydrological function of the river. Further work is required to remove redundant structures and improve fish passage. Full weir removal should be the preferred option where feasible.

Appendix 2(2.2) documents each of the in-channel structures.

Table 21. River Lugg Unit Summaries for In-channel Structures

Unit	Summary	Pass/Fail
4	Along unit 4 there are 8 major weirs, which significantly alter natural sediment transport along the river and impede fish and other fauna passage. Five of the weirs have no fish passage and 3 weirs have a bulkhead present which allows the passage of large salmonids. Weir removal is the preferred option for seven out of eight of the weirs. An options appraisal is required to assess Byton Gauging Weir.	Fail
3	Along unit 3 there are 10 major weirs which significantly impact fish passage. Six of the weirs have no fish pass present, the remaining four weirs have fish passes/bulkhead however passability is poor and restricted to certain species/larger salmonids. Full weir removal is the preferred option for eight out of the ten weirs.	Fail
2	There are five major weirs along this unit. Four of the weirs do not have a fish pass. Further work is required to remove redundant weirs.	Fail
1	There is a single major weir in unit 1, Hampton Court Weir. There is a fish pass in place which has good passability for all species. The weir is utilised for hydropower. The weirs assessment recorded no further action required.	Pass

Figure 60. Location of major weirs along the River Lugg



Fine Sediment

Siltation is described as the unnatural accumulation of silt (fine sediment). Siltation impacts are influenced by catchment land use & modified geomorphology. Abstraction pressure can also alter flow pathways, causing increased deposition of fine particulates.

Excess siltation can profoundly alter the ecology of river habitats by smothering gravels altering the bed habitat, reducing oxygen exchange, and increasing turbidity. Excess silt fills interstitial spaces used by salmonid eggs and benthic invertebrates, lowering spawning success and species diversity. Macrophyte communities shift from clean-water, light-demanding species to silt & shade tolerant taxa. Fine sediment also adsorbs nutrients and contaminants, increasing eutrophication risks. Reduced light penetration, altered flow patterns, and diminished habitat heterogeneity collectively impair ecological function and resilience.

Method

Field observations are used (as part of the RHS survey) to determine the impact of siltation. Silt as the predominant channel substrate & ‘major impacts’ from siltation are both recorded as part of the standard RHS survey.

Condition Assessment

Target: Channel should contain characteristic levels of fine sediment for the river type. No excessive siltation as indicated by:

(a) ‘silting’ highlighted in section P of the RHS form (‘Overall characteristics – major impacts’) OR

(b) one-third or more of the total number of RHS spot checks in the assessment unit have silt (SI) as the predominant channel substrate

Feature Target Compliance: **Fail**

Siltation has been identified as a significant pressure along the River Lugg. Sediment ingress points include field drains & the road transport network. A sediment fingerprinting study has not been undertaken for the River Lugg. Determining the source of silt, i.e. bed, bank, catchment land use, has not been possible using RHS data alone.

Out of a total of twenty assessed reaches, eleven (55%) recorded silting as a major impact. None of the upstream sections in unit 1 recorded siltation as a dominant pressure. Siltation was first recorded as a major pressure at RHS site 5 just downstream of Aymestry. Every site assessed in unit 2 & 3 failed for siltation pressure, with overlying silt recorded along both reaches in unit 3.

Water clarity was also recorded as poor & the water was a murky blue/green colour along a number of reaches. Over widened and over deepened reaches were associated with significant siltation impacts, which may have been as a result of altered hydrology with slower flows depositing fine material.

Table 22. River Lugg Siltation Impacts

Unit	Site	Silt Predominant Channel Substrate	Silting Major Impact	Pass / Fail	Unit	Comments
4	1	no	no	pass	pass	silt not recorded as a pressure
	2	no	no	pass		
	3	no	no	pass		
	4	no	no	pass		
3	5	no	yes	fail	fail	Overlying silt recorded along whole stretch
	6	no	yes	fail		Overlying silt recorded along whole stretch
2	7	no	yes	fail	fail	Silt recorded as a dominant pressure
	8	no	yes	fail		Silt recorded as a dominant pressure
	9	no	yes	fail		Silt recorded as a dominant pressure
	10	no	yes	fail		Silt recorded as dominant pressure, channel murky blue/green colour and where bed visible heavily concreted with silt.
	12	no	yes	fail		Silt recorded as a dominant pressure
1	13	no	no	pass	fail	Silt not recorded as a dominant pressure
	14	no	yes	fail		Silt recorded as a dominant pressure
	15	no	yes	fail		Silt recorded as a dominant pressure
	16	no	no	pass		Silt not recorded as a dominant pressure; however aerial imagery indicates the river is highly turbid grey/brown/green colour and riverbed not visible during survey.
	17	no (20%)	yes	fail		Silt recorded as a dominant pressure
	18	no	no	pass		Silt not recorded as a dominant pressure
	19	no	no	pass		Silt not recorded as a dominant pressure
	20	no	no	pass		Silt not recorded as a dominant pressure
	21	no (10%)	yes	fail		Reach heavily silted and water clarity extremely poor.

Negative Indicators

Non-native species are a significant threat to rivers and can destabilise freshwater ecosystems. Once non-native species have established a self-sustaining population, eradication is challenging & highly resource intensive. Every effort should be made through good biosafety practice to limit the spread of INNS.

Results from the RHS data (which included an assessment of pressures), macrophyte & macroinvertebrate survey data was used to inform the assessment of negative indicators.

Results

Table 23 River Lugg Recorded INNS.

Unit	Plants	Animals	Pass/Fail
4	Himalayan Balsam	American signal crayfish	Fail
3	Himalayan Balsam	American signal crayfish	Fail
2	Himalayan Balsam	American signal crayfish	Fail
1	Himalayan Balsam	American signal crayfish	Fail

Condition Assessment

Target: No high-impact alien species established (i.e. self-sustaining populations).

A site will be assessed as unfavourable when there is good evidence that any non-native species or locally absent species is causing an impact on site integrity

Feature Target Compliance: **Fail**

Invasive species were recorded extensively across the site. Signal crayfish were recorded in every unit; extensive burrow networks along the banks were recorded throughout the majority of survey reaches. The population is established (self-sustaining). Determining the ecological impacts of the signal crayfish was difficult, anecdotally their spread has been associated with increased siltation and deteriorating water clarity. The impact was most significant from RHS site 4 downstream

Himalayan balsam was also recorded extensively along the Lugg. Extensive stands outcompete with native bank vegetation and reduced bank stability due to shallow rooting systems. Where cattle access to the bank was present the Balsam was significantly reduced. Along reaches which had been fenced/with no grazing pressure the Himalayan Balsam was notably more extensive (Figure 61). Refer to Appendix 4 (pressures) for location details of INNS recorded during the surveys.

Figure 61. RHS Site 4. Large stand of Himalayan Balsam along bank top.

Figure 62. RHS Site 14. Crayfish burrows recorded extensively along the River Lugg.

Biological Assemblages

Plant Community

Aquatic plant communities have formed the basis of SSSI site selection for Rivers. The River Lugg citation notes the plant community ranges from naturally species poor in the upland reaches to communities' representative of mature lowland rivers. This combines to produce an assemblage across the catchment of significant interest.

Method

The assessment of plant community condition is based on the assessment of ecological status under WFD, using the LEAFPACS methodology. Surveys are undertaken along 100m reaches and a standard list of species and their cover values are recorded. This information is used along with environmental variables including slope, distance from source & alkalinity, to compare the survey reach against reference values. The results are processed using the LEAFPACS calculator tool to give different metric values including the following:

- River Macrophyte Nutrient Index (RMNI) – provides an index of eutrophication. Higher RMNI values indicate a greater prevalence of nutrient-tolerant taxa and therefore a more eutrophic community.
- Number of Taxa (NTAXA) – index of species diversity
- Number of functional groups (NFG) – index of structural diversity
- Algae cover (ALG) – excessive filamentous algae may have an adverse impact on river ecology

These metrics are combined to give a final ecological quality ratio (EQR). The EQR determines which ecological band the site sits within (Table 24). Unit EQRs were calculated as the arithmetic mean of site EQRs within each unit. River EQR was calculated as the arithmetic mean of all sites across the SSSI.

High ecological status indicates that the macrophyte community is close to reference conditions, with only very minor deviation from natural state.

Table 24. Class boundaries for River LEAFPACS2

Status Class Boundary	EQR
High/Good	0.8
Good/Moderate	0.6
Moderate/Poor	0.4
Poor/Bad	0.2

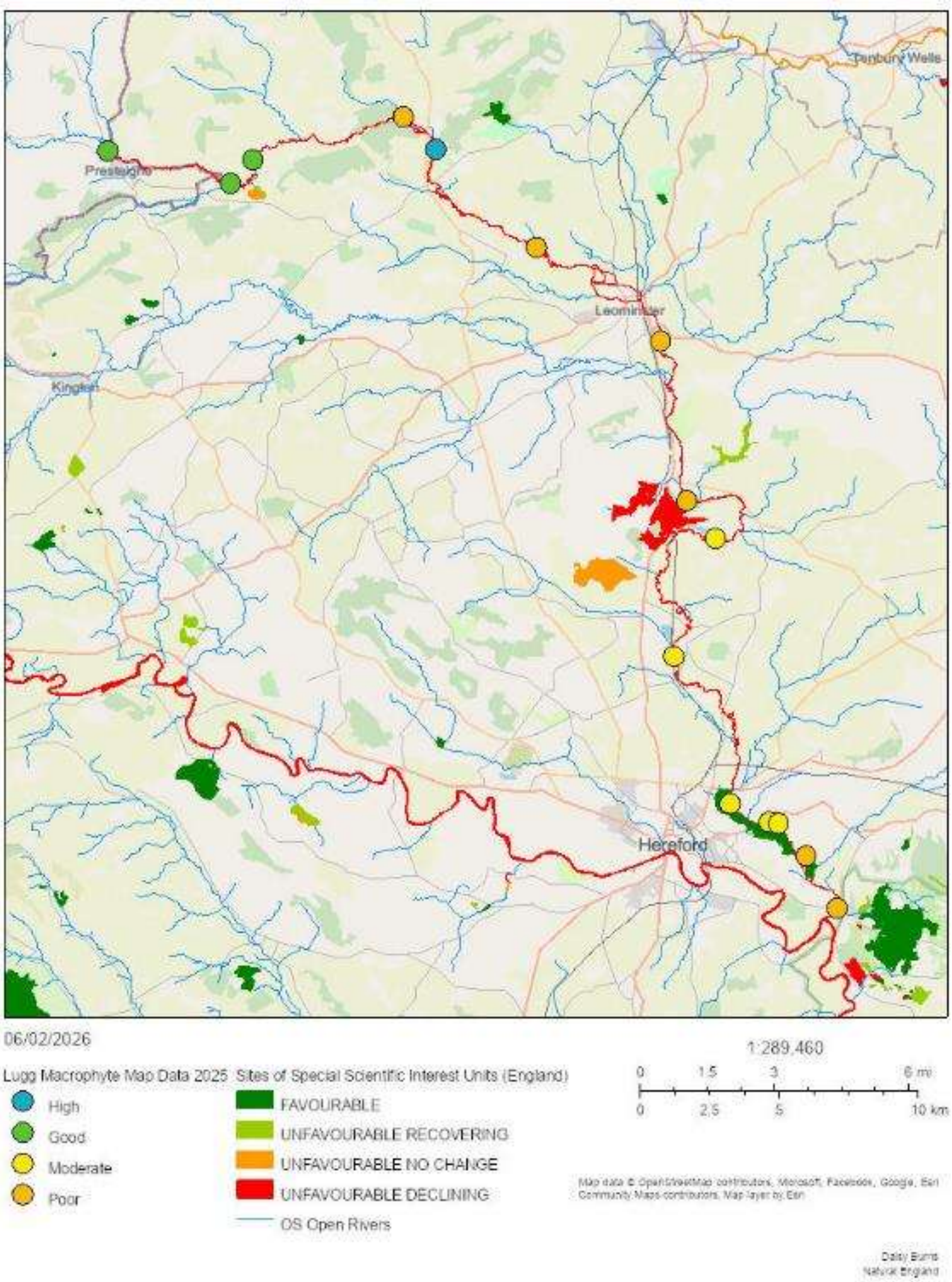
Survey Sites

Macrophyte survey records for the Lugg go back to 1979. There are fourteen original JNCC survey sites covering 7km in total. Twelve macrophyte surveys were undertaken during a week of surveys in July 2025. Macrophyte surveys sites were located to align with the RHS surveys and historic macrophyte sites where possible, taking into consideration the suitability of the reach for surveying. A further four recent EA surveys have also been undertaken and are included within the assessment of aquatic plant condition.

Table 25. River Lugg Macrophyte Sites 2025

Site Ref	U/S GR	D/S GR	Sample Date	Surveyor	RHS Site Ref
Lugg 1	SO3108964981	SO3112764896	05/07/2025	Richard Lansdown	1
EA - 208254	SO3547763751	n/a	09/08/2022	EA	n/a
Lugg 2	SO3625564576	SO3629564629	05/07/2025	Richard Lansdown	3
Lugg 3	SO4164966059	SO4169866011	05/07/2025	Richard Lansdown	4
Lugg 4	SO4282664903	SO4277664823	05/07/2025	Richard Lansdown	5
Lugg 5	SO4640461322	SO4643561261	06/07/2025	Richard Lansdown	6
Lugg 6	SO5080057934	SO5077457869	06/07/2025	Richard Lansdown	8
Lugg 7	SO5166952212	SO5173752197	07/07/2025	Richard Lansdown	12
Lugg 8	SO5268050839	SO5261850803	07/07/2025	Richard Lansdown	13
Lugg 9	SO5117246625	SO5118746559	07/07/2025	Richard Lansdown	15
Lugg 10	SO5294884593	SO5301144537	07/07/2025	Richard Lansdown	17
Lugg 11	SO5312741335	SO5312741277	07/07/2025	Richard Lansdown	18
EA - 227134	SO5454740638	SO 54588 40667	04-Aug-2025	EA	n/a
EA - 227215	SO5485340587	SO 54884 40567	06-Aug-2025	EA	n/a
Lugg 12	SO5583139429	SO5588538964	07/07/2025	Richard Lansdown	20
EA - 45302	SO5695837564	SO 56970 37543	04-Aug-2025	EA	n/a

Figure 63. River Lugg 2025 Macrophyte Surveys & WFD classification scores



Results

Table 26. River Lugg LEAFPACS Macrophyte Survey Results. *River Surveillance Network (RSN) site, not very representative for assessing nutrient pressure (EA pers comm).

Unit	Site	RMNI	NTAXA	NFG	ALG	Site EQR	CLASS	Unit EQR	Unit Class	River EQR	River Class
4	Lugg 1	7.0	7	4	4.3	0.67	Good	0.60	Good	0.51	Moderate
	EA Lugg – 208254*	7.0	5	4	0.1	0.62	Good				
	Lugg 2	6.7	14	6	5.1	0.76	Good				
	Lugg 3	7.6	5	3	45.0	0.34	Poor				
3	Lugg 4	6.5	14	6	2.7	0.84	High	0.59	Moderate		
	Lugg 5	7.7	5	3	38.1	0.35	Poor				
2	Lugg 6	7.6	11	5	63.1	0.35	Poor	0.35	Poor		
1	Lugg 7	7.8	8	5	38.1	0.37	Poor	0.47	Moderate		
	Lugg 8	7.7	8	6	25.1	0.46	Moderate				
	Lugg 9	7.7	10	7	8.6	0.59	Moderate				
	Lugg 10	7.9	7	5	6.0	0.51	Moderate				
	Lugg 11	7.7	12	10	0.1	0.56	Moderate				
	EA Lugg - 227134	7.7	20	11	3.5	0.59	Moderate				
	EA Lugg - 227215	8.2	12	10	1.7	0.42	Moderate				
	Lugg 12	7.9	13	9	62.6	0.32	Poor				
	EA Lugg - 45302	7.9	13	7	32.6	0.40	Poor				

Table 27. Macrophyte species metrics (NE 2025 surveys)

Unit	Site	Total number of species	Scoring Taxa	Aquatic Taxa	Total Macrophyte Cover (%)	Filamentous Algae Cover (%)	WFD Class
4	Lugg 1	27	14	7	20	20	Good
	Lugg 2	41	24	14	20	30	Good
	Lugg 3	23	10	5	5	45	Poor
3	Lugg 4	29	19	14	3	3	High
	Lugg 5	18	9	7	5	30	Poor
2	Lugg 6	27	17	11	5	55	Poor
1	Lugg 7	23	13	8	<1	30	Poor
	Lugg 8	21	13	8	2	15	Moderate
	Lugg 9	21	16	10	20	8	Moderate
	Lugg 10	29	17	7	10	5	Moderate
	Lugg 11	22	16	12	3	1	Moderate
	Lugg 12	26	20	13	15	60	Poor

Macrophyte Reach Summaries

Lugg 1 (Unit 4)

Figure 64. River Lugg Macrophyte Site 1.

Ecological Class: **Good**
Confidence in Class: 83.2%
Total Number of species: 27
Scoring/Aquatic Taxa: 14 / 7

The river is geomorphologically highly natural along this reach, 95% wadable, coarse gravel/pebble unstable bed (70%). Mix of run/glide with some slack water. There is a good mix of bryophytes and vascular plants with typical gravel-bar marginal flora. Dominant taxa include *Cladophora/Rhizoclonium* (C2), Zygnematales (C4), *Fontinalis antipyretica* (C3), *Oenanthe crocata* (C3) & *Ranunculus* (Batrachian) (C3). The RMNI status is higher than expected (6.99 – 6.02) and the number of expected taxa and functional groups is slightly below expected (taxa - 7.03 – 8.830. NFG – 4 – 5.63). Diatom cover 50-75%, identified as *Melosira varians* by J. Doe. Filamentous algae cover 20%, which is likely driving the Good classification status. Site likely impacted by nutrient enrichment.

Lugg 2 (Unit 4)

Figure 65. Macrophyte site 2

Ecological Class: **Good**
Confidence in Class: 76.8
Total Number of species: 41
Scoring / Aquatic Taxa: 24 / 14

The river is geomorphologically intact along this reach with good species diversity. Fully wadable; clear/cloudy mix; gravel pebble mostly run habitat. The RMNI status is higher than expected (6.6 – 6.1) and the number of expected taxa and functional groups is slightly higher than expected (taxa – 14 – 8.89. NFG – 6 – 5.67). Diatom cover <0.1 %. Gravel bar with diverse and typical vegetation. Filamentous algae cover 30%, which is likely driving the Good classification status. Site likely impacted by nutrient enrichment.

Lugg 3 (Unit 4)

Ecological Class: Poor
Confidence in Class: 71%
Total Number of species: 23
Scoring / Aquatic Taxa: 10 / 5

Figure 66. Macrophyte Site 3.

The river is geomorphologically intact along this reach. Only 50% wadable, fast, deep runs, unstable bed; little slack habitat & 100% cloudy. The RMNI status is higher than expected (7.5 – 5.9) and the number of expected taxa and functional groups is lower than expected (taxa 5 – 7.9. NFG – 3 – 4.67). Diatom cover not recorded, probably >50%. Algae cover along this reach was significantly higher than the upstream sites. *Cladophora glomerata* was recorded covering 25 – 50% of the channel with total algae cover estimated at 45%. High algae cover & lower than expected species diversity is driving the poor classification score.

Lugg 4 (Unit 3)

Figure 67. Macrophyte Site 4.

Ecological Class: High
Confidence in Class: 76.7%
Total Number of species: 29
Scoring / Aquatic Taxa: 19 / 14

Geomorphologically highly natural reach with fairly high species diversity. Fully wadable. clear; very coarse bed (50% cobbles); unstable (98%). Very few vascular plants. Number of taxa and functional groups both higher than expected. RMNI also slightly higher than expected (6.45 – 6.09). Filamentous algae cover ~3%. High status is driven by low algae, high species diversity and geomorphology-appropriate community. Site passing for plant community attribute.

Lugg 5 (Unit 3)

Ecological Class: **Poor**
Confidence in Class: 68.3%
Total Number of species: 18
Scoring / Aquatic Taxa: 9 / 7

Geomorphologically intact reach. 70% wadable, heavy silt load; mostly glide habitat. Species diversity lower than upstream sites. RMNI higher than expected (7.73 – 6.35) and number of taxa and functional groups also lower than expected (taxa – 5 – 8.4. NFG – 3 – 5.38). Filamentous algae cover estimated ~30%. Silt-influenced, algal-dominated reach with low species diversity driving Poor status.

Figure 68. Macrophyte Site 5.

Lugg 6 (Unit 2)

Ecological Class: **Poor**
Confidence in Class: 68.5%
Total Number of species: 27
Scoring / Aquatic Taxa: 17 / 11

Geomorphologically intact reach. Only 45% wadable, open and fast; unstable bed. Filamentous algae cover recorded at ~55%, predominantly *Cladophora glomerata*, indicative of high nutrient enrichment. RMNI higher than expected (7.6 – 6.5). Fairly diverse section with number of taxa higher than expected and NFG as expected. Results indicate Poor classification is driven by high algae cover & nutrient enrichment.

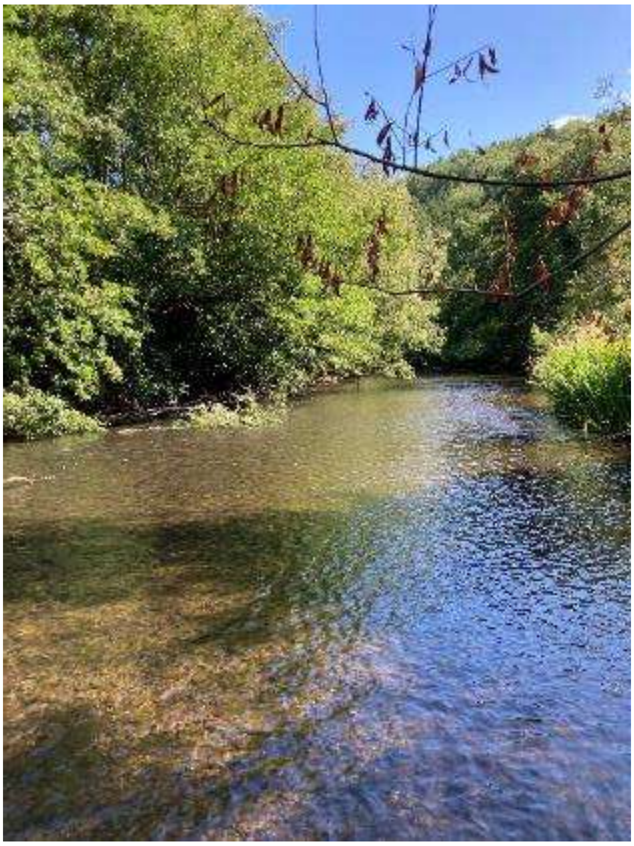
Figure 69. Macrophyte site 6.

Lugg 7 (Unit 1)

Ecological Class: Poor
Confidence in Class: 62.2%
Total Number of species: 23
Scoring / Aquatic Taxa: 13 / 8

Reach recorded as over deepened & heavily silted, running along broadleaf woodland, shaded by very high banks. 50% wadable, heavily shaded by high banks & heavy silt load. Filamentous algae estimated ~30% cover, predominantly *Cladophora glomerata*. RMNI higher than expected (7.76 – 6.50) Speies diversity – number of taxa and functional groups as expected. Light-limited, silty reach where shade suppresses plants but algae still present. Filamentous algae can exploit nutrient under lower light conditions than many aquatic plants.

Figure 70. Macrophyte site 7



Lugg 8 (Unit 1)

Ecological Class: **Moderate**
Confidence in Class: 71%
Total Number of species: 21
Scoring / Aquatic Taxa: 13 / 8

Site recorded as deeply incised with steep banks. 60% wadable, run; gravel bed; 95% unstable. RMNI higher than expected (7.7 – 6.7).and species diversity as expected. Filamentous algae cover recorded at ~15%, predominantly *Cladophora glomerata*. Moderate status driven by nutrient tolerant species and high algae cover, indicative of nutrient enrichment.

Figure 71. Macrophyte site 8.

Lugg 9 (Unit 1)

Ecological Class: Moderate
Confidence in Class: 56.4% (Good – 42.8%)
Total Number of species: 21
Scoring / Aquatic Taxa: 16 / 10

Site historically re-aligned and over deepened with bank and bed re-sectioning present. However, re-naturalising. 70% wadable, gravel pebble bed, mixed run/slack habitat. Site borderline Moderate/Good, EQR = 0.59). RMNI higher than expected (7.7 – 6.7). Species diversity higher than expected. Diverse gravel bar vegetation, including: *Bidens tripartita*, *Epilobium hirsutum*, *Lycopus europaeus*, *Lythrum salicaria*, *Mentha aquatica*, *M. × smithiana*, *Persicaria lapathifolia*, *P. maculosa*, *Phalaris arundinacea*, *Ranunculus sceleratus*, *Rorippa palustris*, *Salix alba*, *Scrophularia auriculata* and *Tripleurospermum inodorum*. No notable taxa. Filamentous algae cover ~8%. Moderate classification appears to be driven primarily by the RMNI score rather than species composition or algae cover.

Lugg 10 (Unit 1)

Ecological Class: Moderate
Confidence in Class: 78.2%
Total Number of species: 29
Scoring / Aquatic Taxa: 16 / 7

Geomorphologically intact but heavily sedimented reach, with extensive cattle poaching. 60% wadable, mostly run, mixed gravel/silt. Diversity of characteristic species but impact from grazing clear. Sufficient species consistent with the diversity of habitats and flow types etc. No *Potamogeton* and plenty of *Cladophora*, the latter being expected for a site with a lot of poached banks and silt inputs. RMNI higher than expected (7.9 – 6.6). Species diversity for taxa and functional groups slightly lower than expected (taxa – 7 – 8.58. NFG 5 – 5.49). Filamentous algae cover at 5%, significantly lower than upstream reaches.

Lugg 11 (Unit 1)

Ecological Class: Moderate
Confidence in Class: 66.8%
Total Number of species: 22
Scoring / Aquatic Taxa: 16 / 12

Figure 72. Macrophyte site 11.

Geomorphologically intact reach running along Lugg Meadows SSSI. Turbid (80%), 95% unstable gravel, mix of run/slack. Relatively species rich. Dog access to the gravel bar means ~20 spp absent which should be there. Some *Potomageton* species present including fennel pondweed and perfoliate pondweed. Freshwater sponge abundant under trees. Low filamentous algae cover ~1%. RMNI higher than expected (7.7 – 6.6). Species diversity significantly higher than expected (taxa – 13 – 8.5. NFG 9 – 5.5). Not clear why site is scoring Moderate status other than higher-than-expected RMNI.

Lugg 12 (Unit 1)

Ecological Class: Poor
Confidence in Class: 74.4%
Total Number of species: 26
Scoring / Aquatic Taxa: 20 / 13

Figure 73. Macrophyte site 12.

Dynamic section of river with classic riffle pool run sequence, various flow types and fairly clean gravels. 90% wadable, very open; fast run with some slack margins. Good species diversity including *Ranunculus fluitans* beds. Freshwater sponge abundant under trees. Species-rich side bar vegetation, including *Barbara vulgaris*, *Bidens tripartita*, *Carex hirta*, *Impatiens glandulifera*, *Lycopus europaeus*, *Lythrum salicaria*, *Mentha aquatica*, *M. × smithiana*, *Myosoton aquaticum*, *Persicaria hydropiper*, *Persicaria maculosa* and *Plantago major*. RMNI score higher than expected (7.9 – 6.6), however species diversity higher than expected (taxa – 13 – 8.5, NFG – 9 – 5.5). Filamentous algae cover 60%, predominantly

Cladophora glomerata. High algae cover likely driving Poor classification score, indicating nutrient enrichment.

Condition Assessment

Target: LEAFPACS tool should give a result of high ecological status for the assessment unit.

Feature Target Compliance: **Fail (Moderate status at whole river scale)**

The river shows a clear transition from mesotrophic to lowland eutrophic plant community, which is strongly controlled by the physical habitat. Across the site 84 species were recorded in total. Species diversity was good, with expected typical range of species recorded.

The majority of sites recorded unstable gravel beds, which corresponded to limited rooted macrophytes. Heavy silt was associated with poor macrophyte cover and shade and high turbidity was also correlated with suppressed plant growth. The occurrence and cover of emergent plants increase downstream.

LEAFPACS analysis of the macrophyte community against a reference natural state indicates the plant community shows significant deviation from reference conditions. This is predominantly driven by the high algal cover which ranges from 1 – 60%, averaging at 25% channel cover. High algae cover is indicative of nutrient enrichment, and this was reflected in the RMNI scores, which were generally higher than expected. Overall, the macrophyte community indicates significant pressure from nutrient enrichment.

The results of the macrophyte community align well with the RHS results. In the upper reaches (Sites 1–4) the macrophyte community is shaped by the geomorphology which is dominated by gravel/pebble beds (45–90%) with very high bed instability (70–98%). The macrophyte cover is mostly low–moderate (3–20%) whilst the filamentous algae cover is high. The species diversity is highest in these reaches averaging 28 species recorded along each reach and WFD classifications of Good & High status. However, two reaches were classified as Poor, due to very high filamentous algae cover (30 – 45%).

Downstream of Kingsland the results of the macrophyte surveys indicate a deteriorating condition in the river quality. Between Kingsland and Hope under Dinmore the species diversity reduced slightly to an average of 23 species and filamentous algae cover is consistently high (30 – 55%).

In the Lower Lugg the classification improves slightly to Moderate, driven by lower filamentous algae score (1 – 60% average 18%), with the exception of the most downstream reach near Hampton Bishop, which recorded FGA cover at 60%. Across the site there is a clear pressure from nutrient enrichment driving high filamentous algae cover.

Historic Comparison

Comparison of historic data is constrained due to changes in survey method, survey lengths and survey locations. Therefore, comparing the results of the exact same sites sampled using the same method has been limited. It is also known that variability between surveyors can be high, especially in recording cover values (Pentecost, Willby & Pitt, 2009). Therefore, apparent changes may reflect method & surveyor differences, along with seasonal impacts of survey timing.

This comparison has used the fourteen original JNCC surveys from 1979 (500m reaches), eleven historic EA sites (1990 – 2025), five LEAFPACS surveys undertaken in 2014 for NE, and the twelve 2025 NE surveys. There are 7 sites available which have data for multiple years of data, which can be used to undertake temporal site comparison. However, the majority of this data was collected from the early 2000's and so interpretation is limited. The analysis focusses on broad scale catchment wide trends, with a focus on a couple of sites to analyse site-specific long-term data sets.

EA SITE_ID (time series)	Years of data	Comparable NE 2025 site (≤500 m)	Comparable JNCC 1979 site (≤500 m)
45302	6 (2013–2025)	N/A	JNCC 2223 – LUGG A
92760	11 (1996–2007)	N/A	N/A
92772	11 (1996–2007)	Lugg 6	N/A
92802	5 (2002–2006)	N/A	N/A
92808	5 (2002–2006)	EA – 227134	JNCC 192 – LUGWARDINE A
100881	3 (2004–2007)	N/A	N/A
165729	2 (2013–2016)	N/A	N/A

Catchment Trends

Analysis of the plant communities over the past 47 years indicates that the physical habitat, which underpins the macrophyte community, has remained broadly the same. Across all records the coarse cobble-gravel bed materials dominate & run/glides are the main habitat surveyed. However, siltation is more evident in the 2025 surveys compared to the JNCC surveys in 1979, with silt recorded more often as a predominant channel substrate.

The most notable difference in the macrophyte data is the cover of *Cladophera glomerata*. Across all JNCC surveys, *Cladophera glomerata* cover is recorded at <0.1%. This is in stark contrast to the 2025 surveys which on average recorded *Cladophera glomerata* cover values of 25%, with reaches recording up to 60% cover. The cover of algae is likely to be directly related to combined effects of nutrient pressures within the catchment, reduced summer flows and increasing summer temperatures.

Analysis of species composition indicates that the riverine species have remained broadly similar. Diversity within the LEAFPACS 100m reaches was on average 26 species. The 500m JNCC reaches recorded an average of 27 species. Considering the far greater cover of the JNCC survey sites, the similarity in species number indicates that there has been no significant loss in species diversity. Macrophyte channel cover was similarly low in 1979, with the majority of species recorded at <0.1% of the channel, reflecting the low stability of the dynamic gravel pebble river.

A comparison of the species found across the catchment in 1979 vs 2026 indicates that the overall catchment species diversity has remained similar with 85 species recorded in 1979 and 84 species recorded in 2025. There are 43 species in common across both survey periods, with 42 species recorded in 1979 and not in 2025 and 42 species recorded in 2025 and not in 1979. Overall, species richness is similar although around half of the species pool has changed. Several differences relate to more explicit naming of algae in the 2025 recordings.

Species which are present in both survey periods include riverine mosses and red algae including *Fontinalis antipyretica* and *Hildenbrandia rivularis* and common emergent marginal plants including *Apium nodiflorum*, *Veronica beccabunga* and *Sparganium erectum*.

2014 Lugg Surveys

Five surveys were undertaken in 2014 across the four units to support an updated condition assessment of the River Lugg (unpublished). Analysis of the macrophyte surveys indicates that the species composition and diversity has remained consistent across the 2014 – 2025 surveys. Whilst the average number of taxa recorded was consistent, filamentous algae cover in the 2025 surveys was significantly higher than in 2014 (Table 28).

Comparison of WFD classification scores indicates that the macrophyte community in the upper catchment (Unit 4 & 3) may have improved since the previous round of 2014 surveys. However downstream along Units 1 & 2 the classifications indicate a deterioration, driven by high algal cover.

It should be noted that 2025 was an exceptionally dry spring and summer in Herefordshire, contributing to one of the most severe droughts in decades and falling significantly below long-term rainfall averages. The region was part of a broader "hot, dry" zone in central and southern England, with rainfall in the Midlands limited to just 56% of the seasonal average (BBC, 2025).

Table 28. Averaged metric score for five 2014 (ECUS) surveys compared to twelve 2025 macrophyte surveys.

Survey Year	Average number of species	Average number Scoring Taxa	Average number Aquatic Taxa	Average Filamentous Algae Cover (%)
2014	23.6	15.6	10.8	3
2025	25.6	15.7	9.7	25.2

Table 29. 2014 (ECUS) Macrophyte Summary Results

Site	Unit	Site comparison	Total number of taxa	Scoring Taxa	Aquatic Taxa	Macrophyte Cover	FGA	RMNI	NTAXA	NFG	ALG	WFD Classification 2014	WFD Classification 2025
Lugg 5 (ECUS)	4 (near Combe)	EA - 208254	19	12	5	<1	1	7.21	6	3	1	Moderate	Good
Lugg 4 (ECUS)	3 (near Lucton)	Lugg 4	21	13	8	1	5	7.53	8	5	3.4	Moderate	High
Lugg 3 (ECUS)	2 (Leominster Golf Course)	Lugg 8 / 7	30	19	12	2	1	6.9	12	7	0.05	High	Poor
Lugg 1	1 (Sutton Saint Nicholas)	Lugg 9	25	16	7	1	3	7.94	7	6	3.85	Moderate	Moderate
Lugg Reserve	1 (Lugg and Hampton Meadows)	Lugg 12	23	18	22	5	5	8.08	11	8	2.25	Moderate	Poor

Site Case Study

Lugg at Mordiford (Unit 1, EA site 45302)

This survey site is the most downstream reach, just upstream of the Wye confluence. Analysis of time series data indicates that species richness has increased, but filamentous algae has also risen sharply since ~2023, indicating a recent shift toward algal dominance rather than long-term loss of plants.

Year	RMNI	RN A TAXA	RFA PC (filamentous algae)
2013	8.14	6	1.75
2016	7.92	9	0.10
2022	7.85	10	0.55
2023	7.59	13	17.60
2024	7.37	10	37.55
2025	7.87	13	32.55

Lugg at Eaton Hall (Unit 2, EA site 92772, NE – Lugg 6)

Species diversity has remained relatively consistent across 25 years. Filamentous algae declined from the peak in 1996 and remained relatively low throughout the early 2000's. However, the 2025 survey indicates a sharp increase in algae cover.

Year	RMNI	RN_A_TAXA	RFA_PC
1996	8.30	13	66.30
1997	8.28	16	19.70
1998	8.56	11	37.60
1999	7.87	11	0.50
2000	7.97	13	1.80
2002	7.59	10	0.60

2003	7.71	12	1.70
2004	7.76	14	0.60
2005	7.84	10	3.50
2006	7.67	15	0.10
2025	7.62	13	63.1

Macroinvertebrates

Joshua Smith (SSSI Monitoring Office, SSSI Monitoring & Evaluation Team)

Macroinvertebrates are an important factor in river condition assessments, being sensitive to changes in conditions including sedimentation, flow, and alterations to the physical structure of a river's course (Friberg *et al.,* 2009).

There are thirteen monitoring sites that have relevant invertebrate data between 2000-2025 across the four units that make up the English River Lugg SSSI. A map of the invertebrate monitoring sites used in this assessment can be found in **Figures 74, 75, and 76.**

WFD Ecological Status

WFD Ecological Status is assessed via the WHPT (Whalley Hawkes Paisley Trigg) analysis. This test produces two scores: NTAXA (number of taxa), which indicates the diversity on site, and ASPT (average score per taxon), which indicates how sensitive the recorded species are to organic pollutants. Together, these two scores are used to produce a WFD status, which gauges the overall health of the river according to the macroinvertebrate community. Condition targets for each score can be found in Table 30**.**

Method

The invertebrate assemblage was assessed in accordance with the UKTAG River Assessment Method for Benthic Invertebrate Fauna from the WFD (Water Frameworks Directive, 2021). The dataset was downloaded from the Environment Agency's ecology & fish database (EA Ecology & Fish Data Explorer). This data is collected via kick sampling for three minutes and a one-minute hand search in spring and autumn (environment agency, 2019).

Three sites with the required metadata for the analysis had records from the last three years (2022-2024). Of those sites, two are located in unit 1, and one in unit 4. Units 2 and 3 have been excluded from the condition assessment (indicated by 'N/D' in Table 31), but as NTAXA and ASPT scores can be calculated in past years from older time series data is presented in the 'Historical Context' section below.

The data was assessed using the River Invertebrate Classification Tool (RICT), which compares predicted and observed scores to produce an indicator of the quality of the invertebrate assemblage in the sample collected.

In accordance with the common standard monitoring guidance (JNCC, 2015), data from the last three years was analysed for each unit and is displayed in Table 31**.** Where data was available from more than one year in the last three, RICT's multi-year analysis feature was used to aggregate data. Where only one year within the last three had data, RICT's single-year analysis was used.

Table 30. EQR Class Boundaries (WFD, 2021)

Status Boundary	WHPT NTAXA EQR	WHPT ASPT EQR
High/Good	0.80	0.97
Good/Medium	0.68	0.86
Medium/Poor	0.56	0.72
Poor/Bad	0.47	0.59

Results

Table 31. WHPT outcomes for macroinvertebrates by unit on the River Lugg SSSI

Unit	Sites	Last Year Assessed	NGR	WHPT NTAXA EQR	WHPT ASPT EQR	WFD Class
4	208254 (Lower Kinsham)	2022	SO3547763751	0.716	1.048	Good
3	N/D					N/D
2	N/D					N/D
1	202895 (Hope Under Dinmore)	2024	SO5178952193	0.697	1.068	Good
1	45302 (Mordiford)	2024	SO5695837564	1.286	1.082	High

Figure 74. Map of the Upper River Lugg SSSI with EA invertebrate monitoring sites

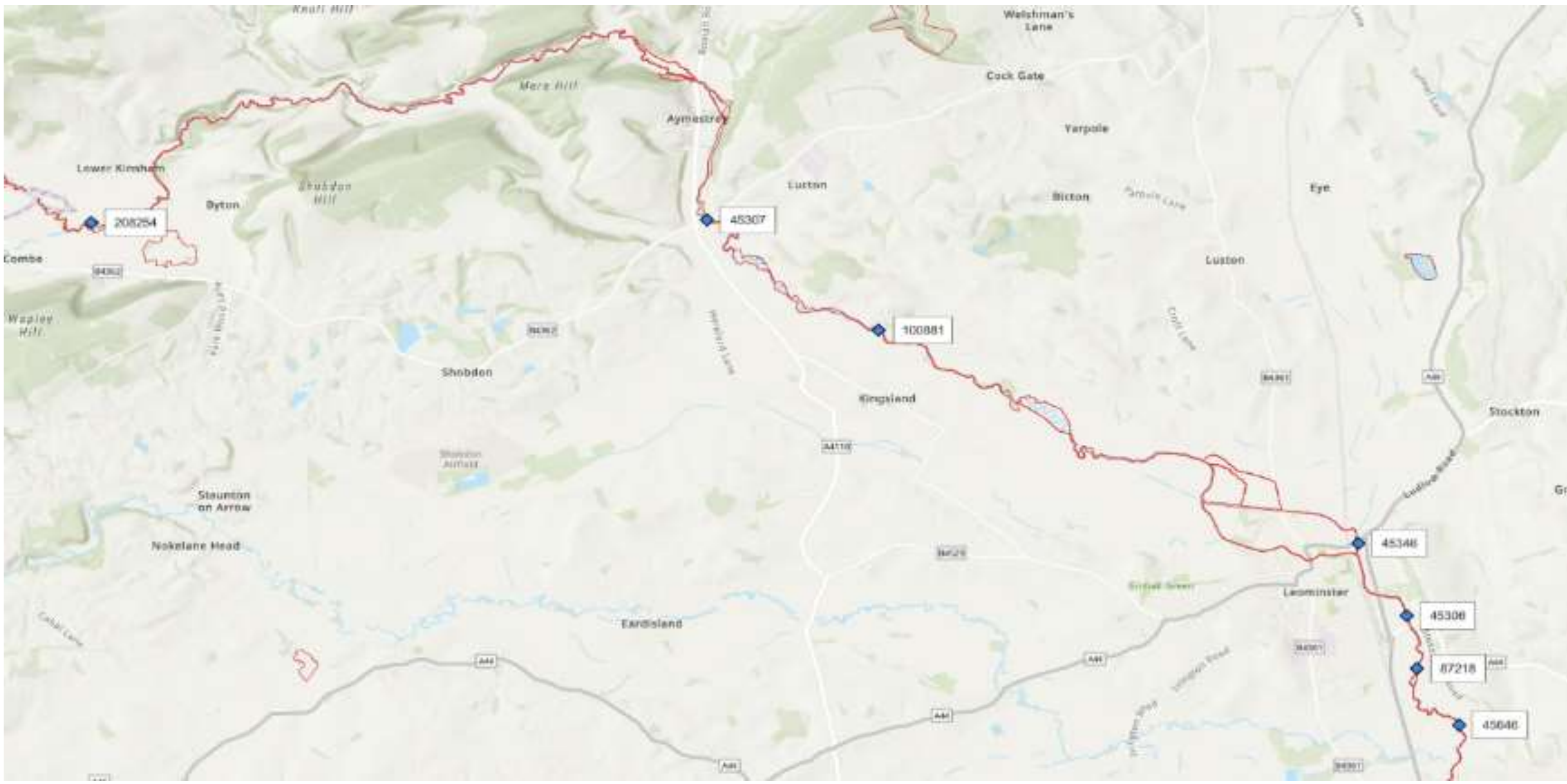
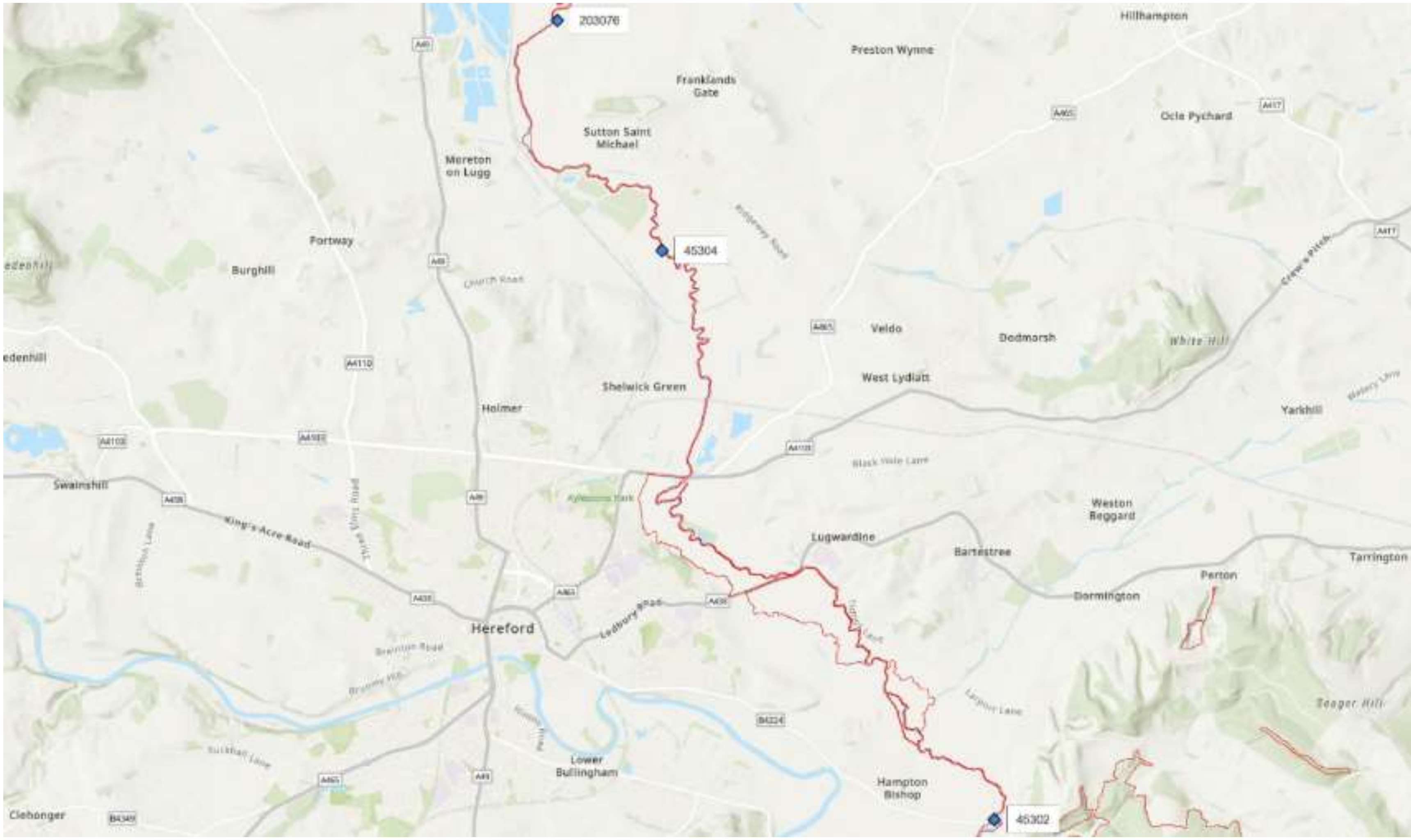


Figure 75. Map of the Central River Lugg SSSI with EA monitoring sites.

Figure 76. Map of the Lower River Lugg SSSI and EA monitoring sites.



Condition Assessment

Target: WHPT tool should give a result of high ecological status for the assessment unit.

Feature Target Compliance: Fail

Unit 4, last monitored in 2022, returned a score of ‘Good’, meaning that it does not meet the requirements for favorable condition status.

Unit 1 had two monitoring sites, both of which had data from 2022 and 2024. Site 202895 returned ‘Good’ status, failing to meet favorable condition, but site 45302 returned ‘High’, meeting the requirement. The CSM is unclear on the course of action in such circumstances, but since the WHPT metric operates on an assumption of ‘worst case’, it is appropriate to take the lower of the two scores as indicative for the unit.

In both failing cases, the NTAXA score failed (see Table 31), while the ASPT surpassed the required target. This indicates that overall macroinvertebrate diversity was low, but some species were present that are sensitive to organic pollutants. This can be typical of stretches of river where organic pollutants are relatively minimal, but other factors are reducing species diversity. In best case scenarios, this can include more specialist habitats that support a lower diversity of species, but more commonly it indicates that other negatives such as inorganic pollution, siltation, or habitat degradation are impacting the area.

Limitations

Units 2 and 3 have no data that is suitable for WHPT analysis since 2014 and 2013 respectively. Additionally, unit 4 only has appropriate data for the year of 2022, making historical comparison impossible.

Historical Context

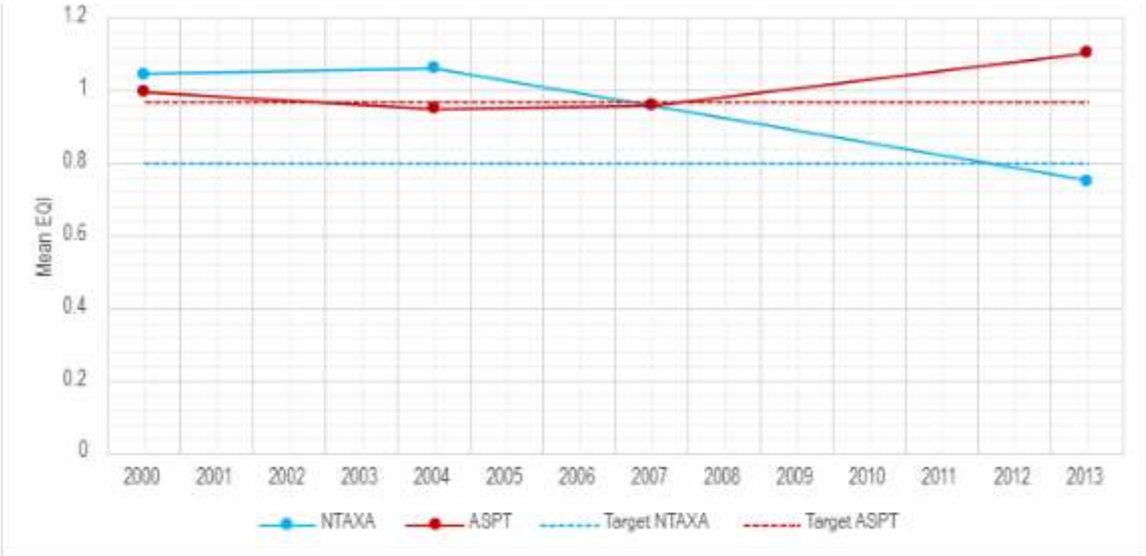
Unit 4

Unit 4 contains one site that has the relevant metadata for a WHPT analysis: site 208254. As such, it isn’t possible to gauge historical trends in NTAXA or APST score for this unit, beyond the fact that it scored ‘Good’ in 2022, failing to meet the criteria for favorable condition status.

Unit 3

Historical NTAXA & ASPT scores for the years available – 2000-2013 – are shown in **figure 77.** Although there are considerable gaps in the time series, this unit has undergone fluctuations in both NTAXA and ASPT. Between 2004 and 2007, the score for NTAXA remained well above its target, indicating that the diversity of macroinvertebrates was high. The ASPT score, on the other hand, remained close to its target, passing in the year 2000 but failing by a small margin in 2004 and 2007.

Figure 77. Yearly Mean NTAXA and ASPT Scores Unit 3 (2000 – 2013)



Unit 2

Figure 78 shows historical ASPT and NTAXA scores for Unit 2 between the years 2000 and 2014. During this time, monitoring was comparatively consistent, with the only gap greater than two years between 2009 and 2013.

The graph shows a relatively consistent ASPT, passing the target in all monitored years. In comparison, the NTAXA fluctuates, failing in 2009 and 2013. This indicates that while this stretch of river experienced consistently low levels of organic pollutants in this period, in these two years non-organic pollution events, may have negatively impacted the overall diversity. It is impossible to determine whether the 2009 and 2013 failing scores are indicative of one continuous or two discontinuous events, as no monitoring was undertaken in the years between.

Figure 78. yearly Mean NTAXA and ASPT Scores Unit 2 (2000 – 2014)

Unit 1

Similarly to the upstream units, Unit 1 shows a relatively constant ASPT score, passing the target for 'High' classification in all years monitored, while the NTAXA shows more fluctuation **(figure 79**). However, while it passes range from considerable margins to extremely close to the minimum target threshold, it only failed in one monitored year (2021). This indicates that, while this stretch of river suffers negative impacts from pressures other than inorganic pollutants, it generally remains in good health. However, it is worth noting that average NTAXA scores have decreased since the early 2000s, suggesting that the overall state of the unit is declining.

Figure 79. River Lugg Yearly Mean NTAXA and ASPT Scores Unit 1 (2000 – 2025)

Notable Species

Species of conservation priority were identified using Pantheon. Records from the last 5 years (2020-2025) were downloaded from the EA's Fish & Ecology portal, screened for duplicates, and uploaded to Pantheon using the Paste & Analyse Species List function.

138 species were recorded, of which 104 could be analysed. Freshwater habitats were the most strongly expressed, with 92 species being indicative of wetland (encompassing in Pantheon both still and flowing water). 77 species were associated with flowing water, 22 with assorted marshland types, and 15 with lakes (note some species may be associated with more than one habitat type). 25 species were associated with fast flowing water, and 20 with slow flowing water. 32 were specifically associated with unmodified fast flowing streams.

Seven species with GB rarity ratings were recorded: two of NR (nationally rare) status, and five NS (nationally scarce). Five species had IUCN statuses other than LC (least concern): two EN (endangered), one NT (near threatened), and two DD (data deficient). One is legally protected as a section 41 priority species. These species are summarized in Table 32

The river Lugg is notable for its invertebrate species, as indicated by the list above. Unit 1 in the region of site 45302 is particularly significant for recurring records on the nationally scarce Mayfly *Allotrichia pallicornis*, an invertebrate that is considered endangered by the IUCN and listed as a conservation priority by the Natural Environment and Rural Communities Act (2006).

Table 32. Notable species recorded from the River Lugg SSSI between 2020 and 2025.

Species	Order	GB Rarity Listing	IUCN Threat Listing	Legal Listing	Years Recorded	Sites Recorded	Units Recorded
Riolus nitens	Coleoptera	NR	EN		2024, 2025	45302	1
Caenis pusilla	Ephemeroptera	NR	DD		2023	45302	1
Macronychus quadrituberculatus	Coleoptera	NS	NT		2024, 2025	45302	1
Riolus subviolaceus	Coleoptera	NS	LC		2021	87218	2
Atrichops crassipes	Diptera	NS	LC		2021, 2022, 2023, 2024, 2025	45302	1
Potamanthus luteus	Ephemeroptera	NS	EN	S41	2022, 2023, 2024, 2025	45302	1
Allotrichia pallicornis	Trichoptera	NS	LC		2022, 2025	45302	1

Condition Assessment Summary

Record: F = Favourable; U = Unfavourable, U – D = Unfavourable - Declining; ND = Not determined; n/a = not applicable.

Attribute	Assessment Unit				Attribute overall
	4	3	2	1	
Flow	F*	F	F	F*	F
Water Quality					
10%ile DO	F	F	U	F	U
BOD	ND	ND	ND	ND	ND
Ammonia(N) 90%ile	F	F	F	F	F
95%ile un-ionised ammonia	F	F	F	F	F
Reactive phosphorus	U	U - D	U - D	U	U
Chemicals	U	U	U	U	U
Habitat Structure					
Channel planform	F	F	F	F	F
Habitat Modification	U	U	U	U	U
Bank Vegetation / Riparian Zone Vegetation Naturalness	U	U	U	U	U
Large Woody Debris	F	F	F	F	F
In-channel structures	U	U	U	F	U
Fine sediment	F	U	U	U	U
Negative indicators					
INNS	U	U	U	U	U
Biological assemblages					
Plant community species and abundance	U - D	U - D	U – D	U – D	U - D
General macroinvertebrates assessment	U	ND	ND	U	U

*Flow compliance in unit 1 & 4 has been assessed as Favourable, however with low confidence due to the borderline compliance at very low flows.

Species Assessment

Otter

Otters are a notified feature of the River Lugg SSSI and mentioned in the citation as a special interest feature of the site. At time of notification field signs were common along the Lugg and it is noted as a strong refuge in central England after the decline in the 1980's.

Approach

Alongside the River Habitat Surveys, surveyors checked for signs of Otter following the method set in the Monitoring the Otter manual: http://publications.naturalengland.org.uk/publication/78009

Surveys were undertaken along the bank on either side of the river up to 300m up and down stream (600m in total) / or until otter signs are recorded.

Data recorded included:

- Whether the site is suitable for findings spraints and /or footprints
- **Presence or absence of otter signs**
- Habitat suitability

Condition Assessment

Target: Spatial extend and density

- Presence recorded throughout all units of the SSSI and the wider functionally linked catchment.
- Population size at least maintained or increasing.
- Presence of enough suitable habitat. No reduced habitat availability.

Feature compliance: Pass

Signs of Otter were recorded extensively throughout the River Lugg catchment. Prints, spraint and signs of feeding were recorded at sixteen out of nineteen sites (84%) and throughout all units. The majority of sites had suitable habitat for holts including extensive tree root systems and temporary resting sites including good tree cover.

Results

Unit	Site Reference (RHS)	Present / Absent	Spraint count	Habitat Features	Notes	Unit Compliance
4	1	Present	0	Lots of resting spots, fallen trees for holts, pools	No presence observed but landowners at site mentioned seeing a large otter in the previous week.	Pass
	2	Absent	0	Lots of resting spots, fallen trees for holts, pools		
	3	Present	1	Lots of resting spots, fallen trees for holts, pools	Feeding stations & crayfish claws spotted.	
	3	Present	1	Lots of trees as potential holt sites, good tree cover, natural channel, fish etc. high-quality otter habitat	Feeding signs also spotted	
3	6	Present	1	Lots of tree cover, deep pools, fallen trees		Pass
2	7	Present	3	Channel fairly uniform, good tree cover.		Pass
	8	Present	1	Good tree cover		
	9	Absent	0	Banks very steep but good tree cover and areas for cover.	Banks very steep and most of river inaccessible so not able to survey very easily as no clear areas to check for signs of otter.	
	10	Present	1	Limited features for resting because of steep banks, good tree cover.		
	12	Present	1	Spraint under the bridge.		
	12	Present	6			
1	13	Present	5	Bridge abutments for resting	Spraints on stone seen from above	Pass
	15	Present	0		Half-consumed signal crayfish	
	15	Present	0	Lots of tree cover, good resting sites	Otter paw print	
	16	Present	0		Footprints	
	17	Present	5	Overhanging vegetation, bridge		
	17	Present	4	Bridge		
	18	Present	0		Verbal record from landowner - otters seen in last 6 months	
	20	Absent	0	Lots of tree cover and good resting sites		

Climate Change Risk Assessment

Climate change is expected to place increasing pressure on the River Lugg SSSI. A warmer, drier, and more unpredictable climate will affect how the river functions, how species respond, and how resilient the system is to existing pressures such as nutrient enrichment, siltation, and hydrological modification. Many parts of the river are already vulnerable due to historic engineering and degraded floodplain habitats, making climate impacts more severe.

Overall climate risk: High

Rising temperatures and algal growth

Warmer water temperatures favour excessive growth of filamentous algae, particularly in sections already receiving high phosphorus loads. This will worsen:

- oxygen crashes
- fish and invertebrate mortality risk
- algal blooms and the suppression of sensitive aquatic plants

High temperatures also reduce the solubility of oxygen in water, making oxygen stress more likely during summer low-flow conditions.

Increased risk of drought and low flows

Climate projections for the region indicate longer and more frequent drought periods. Low flows reduce the river's ability to dilute nutrients and pollutants and increase retention time. In slow-moving reaches these conditions strongly favour algal blooms.
Low flows also:

- reduce habitat availability
- limit fish movement
- concentrate fine sediments
- increase water temperature further

In a catchment where many reaches are already over-deepened or impounded, low flows will have a disproportionately severe effect.

More intense rainfall and erosion

More intense rainfall events can increase the amount of sediment and nutrients washed from fields, roads and compacted soils into the river. Because the Lugg already suffers from widespread siltation, additional inputs are likely to:

- increase turbidity
- mobilise phosphorus bound to soil particles
- reduce spawning habitat for fish

Modified sections of river channel, particularly where banks are steep, bare or eroding are especially vulnerable to these flash-runoff events.

Reduced resilience from historic modifications

The Lugg's heavily modified sections (straightened, dredged, embanked and over-deepened) have limited natural capacity to adapt to climate change.
These sections:

- warm more quickly due to slow flows
- trap fine sediment
- lack natural floodplain connectivity

This means that climate impacts will be felt more strongly in the already degraded middle and lower reaches.

Compounding effect on existing pressures

Climate change does not act alone; it amplifies existing problems. For example:

- High phosphorus + warm temperatures = more severe algal blooms
- Siltation + flash rainfall = greater sediment delivery and turbidity
- Over-deepened channels + drought = longer periods of warm, slow water
- Loss of tree cover + heatwaves = dangerous temperature spikes

These effects create a cycle of decline unless multiple pressures are addressed together.

Evidence Gaps

Although this assessment brings together extensive datasets and field surveys, several gaps in evidence limit the certainty of conclusions and highlight priorities for future monitoring and research. Addressing these gaps will improve the accuracy of future assessments and support more effective restoration planning across the River Lugg SSSI.

Limited understanding of catchment drainage impacts

- Flow analysis assesses the influence from abstractions and discharges, however a comprehensive assessment of natural hydrological functioning, including the influence of land drainage & soil compaction has not been undertaken.

  This is important as it influences both high and low flow events. Catchment drainage exacerbates and increases peak flows as water moves through the catchment to the river more quickly, resulting in increased flooding. Conversely, low flows are also exacerbated as less water is retained in soils, resulting in more extreme low flow events.

Incomplete or inconsistent water quality datasets

- Biological Oxygen Demand (BOD) data were missing at most sites, with no location having a complete 3-year dataset. This limits the understanding of microbial contamination and the biological response to oxygen saturation.
- No long-term monitoring points for trend analysis in the upper catchment (Unit 4).
- Several monitoring points lacked full quarterly coverage across the assessment period, limiting trend analysis. Long term monitoring is essential for understanding trends.
- The continuation of long-term water quality monitoring across the site should be a high priority for future monitoring programs.

Uncertainty around chemical pollutant sources

- WFD chemical failures (e.g., PFOS, PBDE, mercury) are recorded, but the origin and pathways of these pollutants within the Lugg catchment are not well understood.

Historic physical modification impacts are difficult to interpret

- Many of the impacts from physical modifications including historic flood alleviation and drainage schemes are difficult to interpret as they occurred over 50 years ago. The impacts of re-sectioning and dredging will have naturalised to an extent during this time period.

However, physical modifications can accelerate the river downcutting and impact downstream reaches. Interpreting the influence of historic physical modifications and the extent to which the river is over deepened and disconnected from the floodplain is difficult to interpret and define.

Lack of sediment source identification

- Although siltation is widespread, no sediment fingerprinting study has been undertaken for the River Lugg.
- As a result, it is not possible to determine the relative contributions of bank erosion, field drains, agricultural runoff, over-deepened channels, or catchment pathways.

Gaps in understanding the ecological role of invasive species

- Signal crayfish are widespread, but their exact contribution to siltation, turbidity, bank erosion and biodiversity impacts remains largely anecdotal.

Limited temporal comparability in macrophyte datasets

- Historic surveys used different methods, lengths of reach, and timing, making detailed like-for-like comparisons difficult.
- Differences in surveyor estimation techniques, particularly for algae cover, add further uncertainty.
- Although broad trends can be identified, fine-scale changes in community composition over time are harder to interpret.

Limited long-term macroinvertebrate data

- Units 2 and 3 had no suitable invertebrate data for WHPT analysis within the last three years.
- Some units only had a single year of recent data, reducing confidence in status assessments.
- Gaps in the time series between 2009–2013 and after 2014 prevent a full understanding of long-term trends.

Discussion

The results of this assessment show that the River Lugg SSSI is experiencing multiple interacting pressures which are preventing it from functioning as a healthy, natural river system. While some parts of the river remain in relatively good condition, especially in the upper catchment, decline is evident across a number of key attributes.

The overall picture is one of a system under sustained stress from nutrient pollution, sediment loading, physical modification and invasive species. The combination of these pressures has led to a deterioration in the ecological condition of the river and a shift away from the ecological state for which the SSSI was designated.

Catchment Land Use is a key driver of ecological condition

Since the 1970s, UK agriculture has been reshaped by the Common Agricultural Policy (following UK accession in 1973), Green Revolution technologies, and increasing global market integration. Farms in the UK have transitioned from predominantly small to medium scale mixed enterprises, which generally cycled nutrients on farm, to medium-large intensive specialised farms. Specialised farms have a greater reliance on external inputs (fertiliser, feed). This has fundamentally altered the structure of catchment nutrient budgets and pathways (Withers, 2022).

Water quality: phosphorus remains the dominant pressure

One of the most significant factors affecting river condition is elevated phosphorus. The assessment shows that every monitored site fails the orthophosphate target, often by a large margin.

Phosphorus enrichment is strongly reflected in the biological data. High levels of filamentous algae and changes in macrophyte community structure are all consistent with nutrient stress. Long-term datasets in the middle and upper catchment also indicate that phosphorus concentrations have deteriorated since the early 2000s. Although organic pollution indicators such as dissolved oxygen and ammonia are generally within acceptable limits, this does not offset the significant risks posed by chronic nutrient enrichment.

Physical modification is limiting the river’s ability to recover

Historic dredging, straightening, embankment construction and flood alleviation schemes have left long stretches of the river physically altered. These modifications slow flows, limit natural river processes, alter the movement of sediment, and reduce habitat diversity. Downcutting of the river as a result of modification has further exacerbated this problem. In the middle and lower Lugg, large sections of channel are significantly over-deepened and disconnected from their floodplains, which increases their vulnerability to siltation and inhibits natural processes and recovery.

Although the upper catchment retains a largely natural planform, the presence of numerous weirs, most without functioning fish passes, represents a major constraint on ecological connectivity. These structures trap sediment, create impounded reaches, and block the movement of fish and other fauna. Until these barriers are addressed, recovery of natural processes will remain limited.

Fine sediment is widespread and strongly linked to land use and channel condition

Survey data show that siltation is extensive in Units 2 and 3, with more than half of the assessed reaches recording major impacts. Fine sediment smothers gravel beds, reduces spawning opportunities, and alters the composition of aquatic plant and invertebrate communities. Many of the reaches most affected by silt are also those that have been historically deepened or straightened, where low-energy flows encourage sediment deposition.

Land use along the river corridor plays a critical role. Large areas of arable cropping and improved grassland occur immediately adjacent to the river, providing limited buffering and increasing the risk of runoff. Where semi-natural habitats remain, such as woodland blocks or floodplain meadows, they provide valuable protection, but these areas are fragmented and insufficient in extent to maintain catchment-scale resilience.

Biological communities show clear signs of stress

Macrophytes

Although overall species richness remains similar to historic levels, the current plant community is dominated by nutrient-tolerant species and filamentous algae. LEAFPACS results show that most units fall within the Moderate or Poor ecological status classes.

The citation notes that below the confluence with the Arrow brook water crowfoot gradually gives way to large beds of river water crowfoots (*Ranuculus fluitans*). Limited water crowfoot beds were recorded throughout the lower survey reach. The transition towards algal-dominated communities is consistent with high phosphorus levels and increased siltation.

Invasive species are widespread and exacerbating decline

American signal crayfish and Himalayan balsam were recorded throughout the catchment. Both species have the potential to worsen existing pressures: signal crayfish increase bank instability and turbidity through burrowing, while Himalayan balsam reduces bank resilience and accelerates erosion once it dies back each winter. The widespread presence of these invasive species adds an additional layer of ecological stress and complicates recovery efforts.

Otters

In contrast, otter presence remains strong across all assessment units. This is a positive finding, indicating that the river continues to offer suitable foraging and resting habitat.

However, the long-term viability of otter populations depends on retaining fish populations and improving overall river health.

Climate change is likely to intensify existing pressures

A warmer, drier and more unpredictable climate is expected to exacerbate the challenges already facing the Lugg. Higher water temperatures and more frequent droughts will increase the risk of algal blooms, oxygen crashes and fish mortality. Catchment-wide restoration including increasing habitat complexity and reconnecting floodplains is essential to build resilience to climate change.

Recommended Mechanisms & Actions

Achieving favourable condition for the Lugg SSSI, will require a coordinated and sustained programme of action across the catchment in Wales and England.

The River Lugg SSSI cannot be restored through in-channel works and voluntary measures alone; it requires catchment-wide pressure reduction (nutrients, fine sediment, physical modification) in a co-ordinated way.

Achieving the necessary reduction in loads will require significant change in how land is managed, going beyond incremental improvements and business-as-usual approaches.

The current development of a Catchment Wide delivery plan through the Wye Catchment Partnership together with the £1m investment in research for the catchment UWE Bristol leads £1m research into agricultural pollution in River Wye | UWE Bristol, are very welcome and important steps. Given the scale of the phosphate issue in the Lugg, new approaches and innovation need to be identified as detailed in the Diffuse Water Pollution Plan.

Conclusion

The River Lugg is a dynamic, living system which supports a wide diversity of wildlife. However, it faces sustained and continuing pressures. The pressures facing the River Lugg are systemic, multi-dimensional and result from catchment land use change over the last century. Current actions and mechanisms are not adequate to restore the river & climate change will further exacerbate existing problems. A system shift in governance and land use is required to restore the site to a thriving ecologically resilient system.

Acknowledgements

I would like to thank all the landowners who allowed access onto their land to undertake surveys and data collection in 2025. Your co-operation is highly appreciated.

Thank you to the Environment Agency for the long-term program of monitoring on the River Lugg. The data collected by the agency is vital in understanding long term trends and catchment wide pressures.

Thank you to Natural England's West Midlands area team for your support in undertaking the surveys.

Appendix

1. **Water Quality Analysis**
   1.1 Water Quality Table
   1.2 Plots

2. **Physical Habitat Data**
   2.1 RHS Forms
   2.2 Data Analysis

3. **Macrophyte Data**
   3.1 Survey Forms
   3.2 Analysis
   3.3 Photos

4. **Pressure Data**

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ISBN 978-1-84754-xxx-x

Catalogue code: NExx

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NATURAL ENGLAND

Update on the Condition of the River Lugg SSSI

Natural England – 2026

Natural England has recently completed an updated condition assessment of the River Lugg Site of Special Scientific Interest (SSSI). This river is nationally important for its diverse aquatic plant communities and the habitats it provides for wildlife such as otter.

The assessment brings together over 40 years of monitoring data, alongside new field surveys completed in 2025. It considers river flow, water quality, habitat condition and wildlife, and how land use across the catchment is influencing the river today.

Pristine reach near Aymestrey. The river here is connected to its floodplain & displays classic run-riffle-pool habitat.

Key Findings

• **The river supports diverse and important wildlife**, including nationally scarce invertebrates and a widespread otter population.

• **River flows are generally near natural,** abstractions and discharges are compliant with flow conservation targets.

• **Nutrient levels (phosphorus) are too high across the whole catchment**; targets are exceeded at all monitoring sites and phosphate concentrations have increased in the upper and middle catchment over the past fifteen years.

• **Sections of the river have been historically modified (1950's – 1980's)**, especially around and downstream of Leominster, including dredging, straightening, and embankment.

• **Fine sediment (silt) is widespread**, particularly in the middle and lower river.

• **Aquatic plants show signs of nutrient stress**, with increased algal growth and changes in species composition. **Invasive species** including Himalayan Balsam & Signal Crayfish exacerbate existing pressures.

Overall, the River Lugg SSSI is in an Unfavourable – Declining condition.

While parts of the river remain in good condition and retain high ecological value, a number of pressures are affecting the river's ability to function as a healthy resilient system.

Why This Matters

Rivers rely on a balance of clean water, natural flows, and varied habitat to support wildlife. When nutrients and sediment enter the river in excess, they can:

- Encourage excessive algal growth
- Smother gravels used by fish and insects
- Reduce water clarity and plant diversity

Over time, these impacts reduce the health and resilience of the river, making it more vulnerable to other pressures.

The River Lugg near Leominster has been historically dredged, resulting in slower flows, siltation and high filamentous algae cover.

Climate Change Risk

The River Lugg is vulnerable to a changing climate. Hotter, drier summers are likely to reduce flows and increase water temperatures, while heavier rainfall events can increase runoff of soil and nutrients into the river. These changes amplify existing pressures.

How Land Management Can Help

Improving the river now depends on coordinated action by landowners and statutory bodies working together. There are many practical actions that can make a meaningful difference:

Reducing Nutrient Loss

- Match nutrient applications to crop and soil requirements through regular soil testing and nutrient management planning.
- Reduce phosphorus surpluses by balancing nutrient inputs and outputs across the farm.
- Store, transport and apply manures & anaerobic digestate responsibly, ensuring nutrients are used where they are needed and do not accumulate on already nutrient-rich land.

Limiting Sediment Runoff

- Maintain good soil structure and year-round cover, particularly on vulnerable soils and slopes.
- Reduce cultivation of high-risk crops, including maize and potatoes, on steep slopes and fields prone to erosion.
- Reduce poaching and erosion from livestock access to rivers and streams.

Improving Riverside Habitat

- Create wildlife corridors alongside watercourses
- Plant and manage trees where cover is lacking to provide shade and bank stability
- Reduce intensive land use directly adjacent to the river

Supporting Natural River Processes

- Where possible, allow the river space to reconnect with its floodplain
- Remove or adapt in-channel structures such as weirs where feasible

Managing Invasive Species

- Control Himalayan balsam
- Support coordinated catchment-scale control efforts

Working Together

The River Lugg remains a valuable and ecologically important river.

Many of the actions outlined above can be supported through agri-environment schemes and other funding opportunities, helping to balance environmental improvements with productive land use.

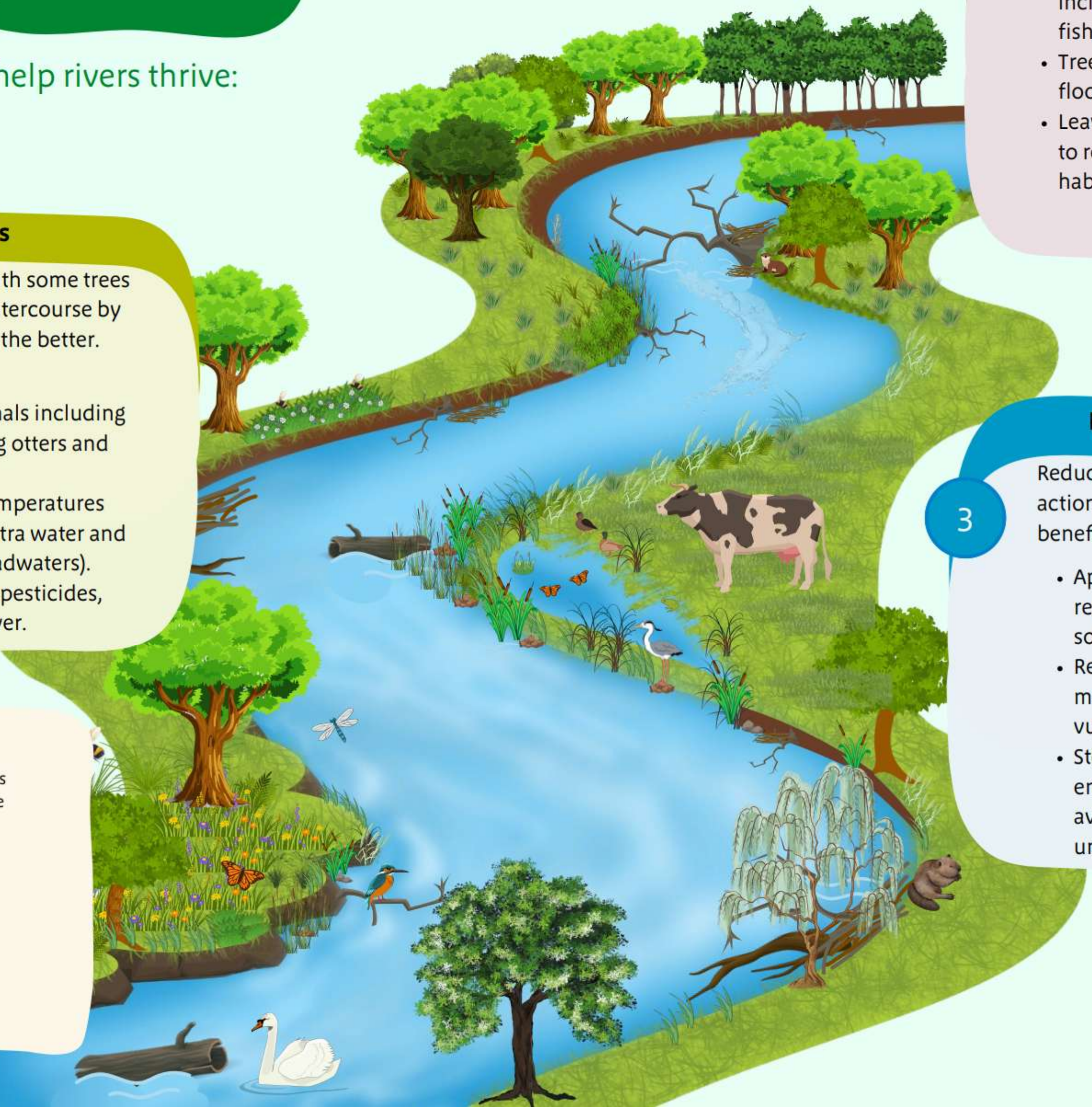
Natural England, the Environment Agency and partners are committed to working with landowners to support these changes.

Contact Natural England to discuss opportunities for working together: csf.severn@naturalengland.org.uk

Go With The Flow

Improving SSSI river condition

3 key changes you can make to help rivers thrive:



1 Leave fallen living trees and deadwood in the water

This benefits both the environment and your land by:

- Creating areas of faster and slower flowing water including pools. This creates fantastic habitat for fish and invertebrates to thrive.
- Trees in rivers can help to slow the flow during flood events, helping to reduce the flood peak.
- Leaving fallen trees rooted into the bank can help to retain bank stability whilst creating valuable habitats such as otter holts.

2 Create wildlife rich corridors

Manage a corridor of water loving plants with some trees like willows, alder and aspen along your watercourse by light grazing or sensitive cutting. The wider the better. This is important as riparian habitats:

- Provide shelter and food for many animals including insects, fish and other wildlife including otters and bats.
- Provide shade helping to keep water temperatures cool in hot weather & help to absorb extra water and mitigate flood risk (especially in the headwaters).
- Natural vegetation filters out nutrients, pesticides, and sediments before they reach the river.

3 Reduce nutrient losses from your land

Reducing nutrient losses is one of the most important actions for restoring healthy rivers and has multiple benefits for your farm:

- Apply fertilisers and manures according to soil and crop requirements using nutrient management planning and soil testing.
- Reduce soil erosion and runoff by improving soil health, maintaining ground cover and managing cultivation on vulnerable land.
- Store, transport and apply manures responsibly, ensuring nutrients are used where they are needed, avoiding nutrient applications when conditions are unsuitable.

Help is available to improve SSSI river condition

There is lots of help available to achieve these three actions through Countryside Stewardship Higher Tier including the following options:

- 6m to 24m 3-dimensional (3D) buffer strips (CSW 21)
- Manage riparian and water edge habitats (CSW 25)
- Enhance floodplain storage supplement (CSW 26)
- Make room for the river to move (CSW12)
- Connect river and floodplain habitats (CSW 22)

Contact the protected sites mailbox today
ProtectedSites@naturalengland.org.uk

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Wye Catchment Management Plan (Wye CMP26) Phase 1- Evidence gathering and Report

Progress to date

- April – Evidence gathering phase closes following extension
- May – Haskoning collate evidence into an Evidence Report
- May/June – Task and Finish group and those who submitted evidence review the Evidence Report
- June – Haskoning begin to review comments (600+) and propose approach to comment resolution
- June – Task and Finish group discuss proposal and feed back to Haskoning
- June/July – Haskoning action critical amends to report

Next steps:

- July – Task and Finish Group meeting and review Evidence Report for a second time

Wye Catchment Management Plan timescales

Stage	Task	
Evidence review	Review of data / studies	Feb – March 2026
	Evidence review report	April – July 2026
Options appraisal	Generate long list	July 2026
	Evaluate options	August 2026
	Options appraisal report	Late summer 2026
Action Plan	Draft CMP	Autumn 2026
Stakeholder Consultation	Consultation of Draft CMP	Late Autumn 2026

Nutrient Management Plan

Stage	Task	
Evidence baseline report	Review of data / studies	
	Evidence review report	July
Options appraisal	Generate long list	August
	Evaluate options	August
	Options appraisal report	September
Action Plan	Draft NMP Action Plan	October
Report Finalisation		Late October/ Early November