Herefordshire Council

Unlocking new housing in Herefordshire

Luston Wetland Case Study

Why establish the Luston wetland?

The creation of the Luston Wetland forms part of Herefordshire Council's approach to tackle the challenge of meeting nutrient neutrality requirements as specified under the Habitats Regulations. In successfully achieving this breakthrough, it enables the unlocking of planning applications by accommodating the offsetting of nutrient discharge and reducing nutrient phosphates in wastewater.

Housing development was halted in the River Lugg sub catchment area in 2019 when Natural England advised that new housing development should only proceed if normal household cleansing activities (laundry, washing, cleaning, bathing and toilet use) did not add any additional phosphates to the Lugg sub-catchment. Effective mitigation measures needed to be put in place to prevent additional phosphate pollution. Adding a constructed wetland to further clean the outflow from Water Treatment Works was identified as the best mechanism to do this.

The new wetland now allows development to continue while protecting the environment. It also provides a natural asset that enhances its locale and promotes biodiversity, encouraging flora and fauna species to inhabit and revitalise the surrounding rural ecosystems.

Designing the wetland

Choosing and securing the site

Herefordshire Council asked the Wye & Usk Foundation to assess suitable sites ensuring they fulfilled key criteria, including being adjacent to an existing treatment works that had sufficient capacity to deliver the required level of water discharge. The topography of the land needed to be conducive to wetland development and the soil type contained sufficient layers of clay to retain water. Furthermore it was essential that new site was not located within a high flood risk area.

Following closer examination of suitable sites, discussions with Dŵr Cymru Welsh Water identified the most suited treatment plants for connecting to a new wetland, and were followed with feasibility studies assessing the phosphate output. The Herefordshire Council team finally selected Luston, and the 3.46-hectare (8.5-acre) site purchased from a supportive landowner.

Stages of construction

Construction of the wetland commenced in August 2022, with water industry engineering and construction specialists JR Bentley. Key stages of construction ran as follows;

STAGE 1

On completion of mapping and surveying of the site, a new access road with a temporary works surface was constructed to allow vehicle access to the wetland site and the culvert. Works were modelled by WSP Consulting (engineering) and JBA Consulting ensuring that construction of the wetland received Ordinary Watercourse Consent from the Internal Drainage Board to enabling the wetland to discharge into the neighbouring brook.

STAGE 2

The areas marked for the newly constructed cells were cleared of vegetation and top layer of soil. Digging of the individual cells commenced, meeting the specification for size, levels and depth to ensure the flow rate and retention time allowed for optimum phosphate removal.

STAGE 3

Clay excavated on site was used to line the cells. The presence of clay in the sub-soil allows a natural clay liner to be formed at the base of the wetland via compaction known as puddling; creating an impermeable layer to reduce infiltration and risk of groundwater contamination.

STAGE 4

Planting of the cells with a selection of marginal and aquatic species specified for each cell. Switch on of water flow pipeline for testing of cells and successful treatment of water and its discharge.

STAGE 5

Once construction was completed and vehicles and machinery plant removed, landscaping of the finished site surrounding the cells was seeded with wild meadow species. Planting of native tree species on the south of the wetland to maintain biodiversity, in line with Herefordshire Council's recommendations role as responsible authority for local nature recovery.

Construction – integrity of structure and materials used

As a nature-based solution the wetland is constructed and reliant on natural elements, the clay and vegetation. The addition of a concrete culvert and pipeline (manufactured to British Standards) that supplies the wetland cells are the only man-made materials used. This ensures that the wetland construction and engineering approach complies with Natural England's preference for a 'nature-based solution', and operates within a carefully documented and controlled environmental management system. By doing so it fulfils the requirement of the Environment Agency Regulatory Position Statement (a document issued by the Environment Agency indicating the minimum environmental protection standards the Wetland needs to continually achieve).

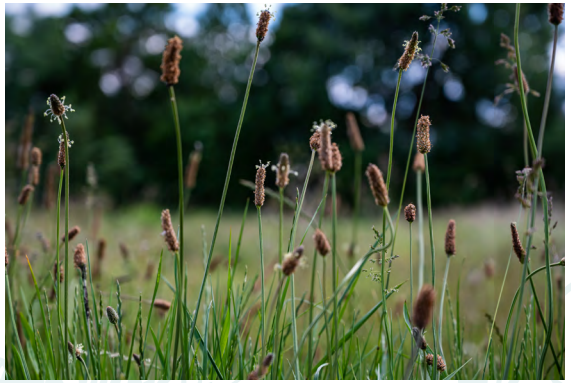
The cells vary in size – cell 1 (4,200 sqm), cell 2 (5,260 sqm), cell 3 (4,740 sqm). The variety of plant species used, and numbers planted follow specified proportions to ensure the phosphorous reduction is maximised, and not compromised by a single species becoming too dominant at the same time encouraging biodiversity. The depth of planting for each species is also essential to ensure their survival and ability to thrive, thereby maintaining the effectiveness of the cell and optimising the wetlands' performance.

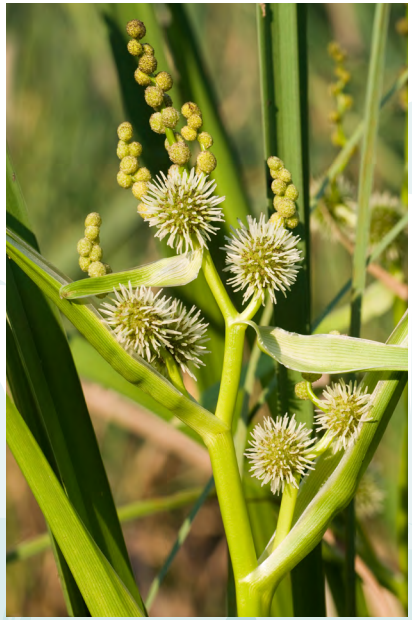
Planting out the wetland

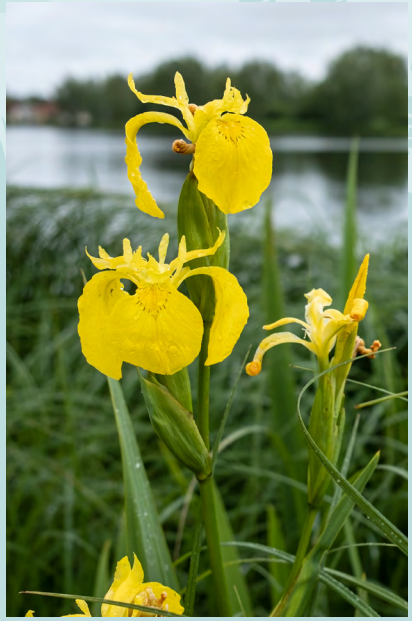
Plant species chosen (by WUF in collaboration with plant specialists and the Councils ecology team) were selected on their ability to remove phosphate. A selection of 14 species were planted over depths of 5cm-20cm within the sloping cells. A total of approximately 85,000 plants were planted across the cells, embedding them in the clay lining. The plant roots do not compromise the infiltration rate of the lining as clay is self-sealing, and the slow build-up of materials at the base of the wetland over time further impedes infiltration.

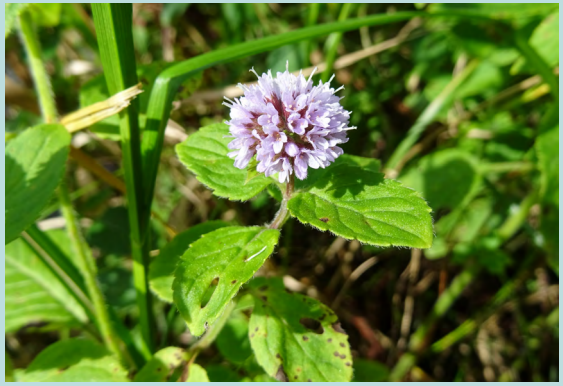
The Environmental Management System compiled by Leppitt Associates, ensures the wetland is constructed and maintained to a standard that fulfils key requirements for a minimum 80-year period. In doing so it meets the regulatory position statement issued by the Environment Agency as a waste site, which in itself was a pioneering step and represented a significant stage in the development of the wetland as a long-term mitigation and restoration solution.

The wetland will therefore continue to be operational for between 80-120 years 'servicing' those homes linked to Luston (from their planning approval), by offsetting the phosphates generated by those households.









Some of the 14 different wetland species planted at Luston.
Mentha aquatica (Left)
Eleocharis palustris (Top Left)
Schoenoplectus (Centre left)
Typha angustifolia (bottom left)
Sparganium erectum (Top right)
Iris pseudacorus (Bottom right)

What does the wetland deliver?

Removal of phosphates

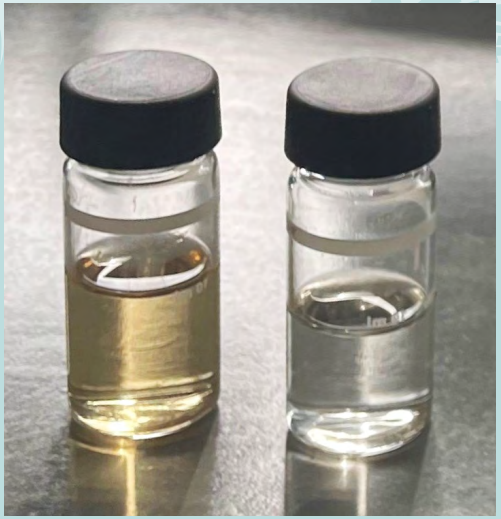
Luston Wetland is more than a ‘wetland’ and does more than just remove phosphates from wastewater. It is the first wetland that has been designed and engineered to act as mitigation asset, delivering a verifiable evidence base that enables an accurate calculation of phosphates. This provides a robust platform upon which valued phosphate credits are traded to allow the release of planning approvals for the building of homes.

Accreditation and licensing

The pioneering developments of the Luston Wetland project were independently reviewed, confirming that the technical capability of the wetland met with the highest quality assurance standards. The trading framework also underwent rigorous legal review to ensure it was fully compliant with legal requirements, where the credit allocation and trading processes were accurate, reliable, robust and deemed completely watertight. The standards fulfilled the requirements of the Environment Agency meeting and establishing new criteria stipulated within the agency’s Regulatory Permission Statements.

The wetland was designed using data collected from the outflow at the Dŵr Cymru Welsh Water plant at Luston. Flows and nutrient levels were modelled to determine the retention time water needed to stand and move through the cells and establish the required treatment area needed, which would shape the size of the wetland. Modelling and scoping using the data was undertaken by Chartered Environmentalist Rob McInnes and independently verified by Ricardo (environmental & engineering consultancy).

From the data modelling, it’s calculated that Luston will be able to remove at least 228.2kg of phosphates per year, to the required level of scientific certainty based on present monitoring data. As monitoring data improves we expect the level of scientific certainty to provide assurance that a total of 310kg of Phosphate reduction may be achieved. The Council will continue to adopt a very cautious approach only releasing further credits from the site when longer term monitoring data fully supports such a decision.



Water collected from the Luston Wetland site.

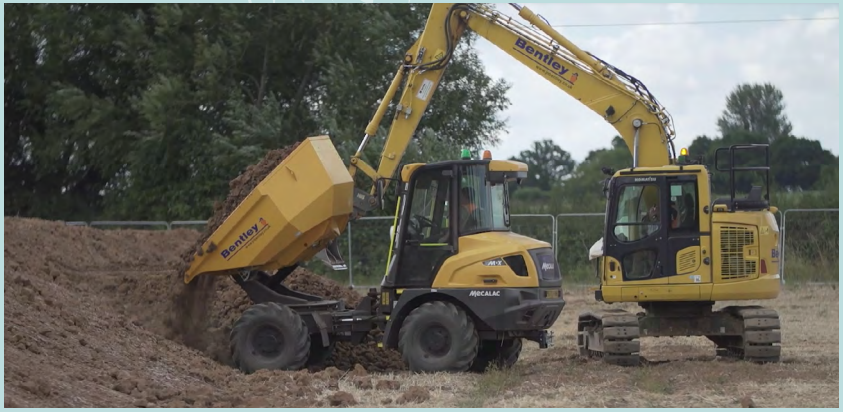
The murky ‘before‘ sample (left) and the clear ‘after’ sample (right) show how well the wetlands are cleaning the water.

How does this impact upon planning applications, housebuilding, and construction projects?

Herefordshire faces extreme challenges in addressing the build-up of phosphates due to agriculture, livestock farming and the permeability of its soils, which are unable to utilise or retain phosphates thereby entering watercourses and ultimately polluting the rivers.

Herefordshire Council paused housebuilding across 40% of Herefordshire in response to Natural England's guidance for nutrient-neutral development measures to be applied (in an attempt to significantly reduce the level of phosphates entering the watercourse). This remained in place while a mitigation solution was being developed, the backlog of planning applications demanded a revolutionary set of solutions.

Construction and creation of homes represents an increase in phosphate entering the waterbodies from point source pollution (WWTW). Therefore, any construction project demands mitigation of the phosphate in addition to the efforts required to stem and reduce the level of phosphates present across the county and wider Wye Catchment, notably within the Wye Special Area of Conservation (SAC) and the Lugg sub-catchment.



Mitigation trading scheme and nutrient neutrality

Each development proposal is assessed for planning purposes and the phosphate loads are calculated to reveal the weight (kg) of phosphates that will be generated, and the value of credits which need to be funded and/or traded. The amount of credits may be reduced if Sustainable Drainage Systems (SuDS) feature as part of the proposed build within the planning application. The estimated cost per household is £2000-£3000.

Credits will be released gradually to accommodate mitigation requirements and in line with removal rates. At our Luston site, 20% of phosphate removed will not be traded, the offset allowing for river restoration resulting in cleaner water, healthier watercourses, and river betterment.

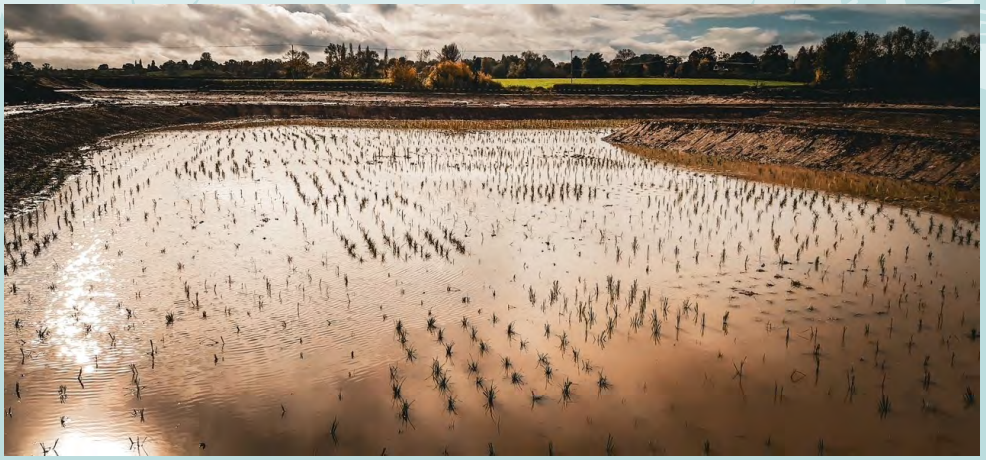
Innovating and creating ground-breaking solutions

Luston Wetland is a nature-based solution and not hard engineered. It's recognised as the World's first wetland to be used for specifically trading credits, as part of a mitigation scheme that can accommodate development that is fully compliant having undergone and completed Habitats Regulations Assessments (HRA). Taking the leading role in nutrient neutrality while being accepted by the statutory government agency for landscape and nature - Natural England - Luston represents a pathfinder initiative that serves as a blueprint for further nature-based nutrient mitigation projects undertaken by Local Authorities and legislative bodies nationally.

Collaborative working, sharing best practice, and technological innovation

Luston is the latest development in a sequence of notable ground-breaking initiatives that have since been adopted nationally, and applied in the task of tackling nutrient mitigation and phosphate management programmes.

- Herefordshire Council created the first Phosphate Budget Calculator with environmental specialists, Ricardo PLC. This provided an accurate tool to assess the nutrient volumes of housing development and proved to be the prime mechanism to help scope the required mitigation response. The Phosphate Budget Calculator was subsequently adopted by Natural England as a verified tool that is now used across the UK by local authorities and agencies, helping create and deliver nutrient neutrality programmes.
- By providing two years of insights, data and feedback, Herefordshire Council enabled the Environment Agency to create a Regulatory Position Statement (RPS) so any new 'waste wetland' (for treated effluent wastewater discharge) does not require a permit and certification.
- Trading Platform – Development of an in-house trading mechanism (incl. processes and recording systems templates) to deliver a system that equipped Herefordshire Council to trade the credits without the need for an external trading partner.
- Centre of Expertise – a resource available for developers and businesses to use, offering bespoke advice for specific projects. We are developing our team to provide a hub of expertise that offers developers support on creating private mitigation schemes - Nutrient Management - guidance for developers. In addition, guidance for other Local Authorities looking to construct wetlands and alternative mitigation schemes.
- Local Authorities Collaborative offering - sharing the design expertise, technologies and capability with other local authorities who wish to introduce comparable schemes through Herefordshire's in-house private mitigation, nutrient neutrality service.



Partners and collaborators

- Dŵr Cymru Welsh Water
- Environment Agency
- Internal Drainage Board
- JBA Consulting (environmental, engineering, ecology)
- JR Bentley
- Leppitt Associates
- Marches LEP
- Morgan Sindall Group
- Rob McInnes - Chartered Environmentalist
- Natural England
- Ricardo PLC (Environmental and Engineering Consulting)
- Rivers Trust
- Salix
- WSP Consulting
- Wye and Usk Foundation

Herefordshire Council would like to thank all our partners, collaborators, and investors for their unstinting support. We appreciate the help and contributions from the academic and scientific communities, from business, industry and engineering sectors, the voluntary and NGO bodies and the many advocates and contributors.

We look forward as we continue to work together on addressing the challenges of tackling nutrient phosphate pollution, and implementing those solutions that will restore our rivers and equilibrium to our ecosystems, the environment, the economy, and our communities.

August 2023