

# INTEGRATED CONSTRUCTED WETLANDS: THE START OF A JOURNEY

Rob McTaggart and Linda Hustler discuss why Integrated Constructed Wetlands (ICWs) are vital to delivering sustainable long-term low carbon solutions, how these can be used within flexible permitting through an Operating Techniques Agreement (OTA) and how they help us meet the challenge of nutrient neutrality.



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We recognise that we must think differently and embrace new methods, metrics and measures appropriate to general catchment solutions – including ICWs if we are to realise the full range of benefits available.

Integrated constructed wetlands (ICWs) are a growing part of the infrastructure mix to meet the challenge of excessive input of nutrients (principally nitrogen and phosphate) into the UK's rivers and lakes. ICWs are more than just a narrow fix to a single issue; they have the potential to offer wider benefits to a sustainable economy and society. However, we need to find the balance between the romantic notion that ICWs are the purifying kidneys of our landscape and the harder engineering view that ICWs are simply reeds in a box installed to achieve an end of pipe limit.

The key word in ICW is integrated. Constructed wetlands achieve more



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when they integrate into the surrounding environment. It is through this appropriate combination of environmental and asset focused measures that we realise wider benefits that lead to enhanced ecosystems services and natural and social capital (a key policy in the UK government's 25-year Environment Plan) compared to a purely 'grey' solution. What we must remember is that the water industry has spent decades perfecting concrete solutions to meet environmental regulator expectations and both the industry, and the regulator need fundamental shifts in mindsets to realise the benefits of integrated wetland systems; it's a journey we have started but we still have a long way to go.

Excessive nutrient input into water ecosystems is a significant environmental issue with over 50% of English waterbodies and N2K sites failing their targets for phosphorus. This nutrient load can lead

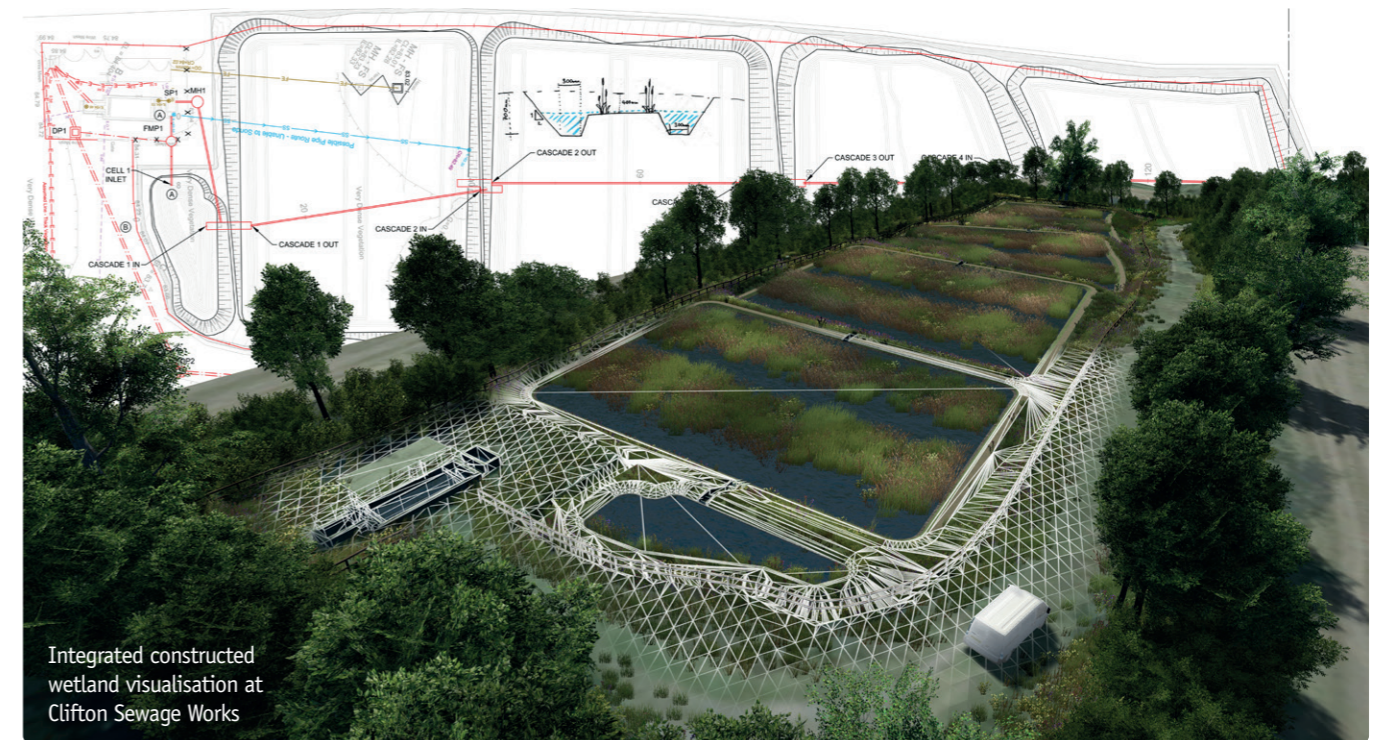
to eutrophication, unstable freshwater ecosystems and potentially unfavorable status at our protected areas.

### Why change - Water Industry?

Environmental regulation has been founded on the principle of the polluter pays. This is typically interpreted as each sector must in turn reduce its fair share to the target safe limit, regardless of the resources used to attain the reduction. This sum of the parts approach is at best inefficient and siloed and at worst ineffective and diminishes the potential for collaborative innovation.

Environmental regulators have recognised that a blended system-based approach will deliver a more sustainable outcome. It has taken the welcome step of offering the water industry a risk sharing mechanism in the form of an OTA. These agreements provide a safer environment to explore innovative approaches and ways of working which achieve water quality objectives, whilst reducing energy use and carbon emissions and obtaining additional benefits associated with nature-based solutions, such as increasing natural, economic and social capitals, biodiversity, and improved flood management and well-being.

One of the areas for which OTAs have been developed is the use of ICWs. The more traditional solution for most wastewater treatment works - and in particular smaller works - is chemical dosing – usually iron or aluminium compounds. Dosing is an effective way of reducing phosphorous in WWTW effluent, however, it comes at huge global and local cost: mining, long-distance transportation, chemical



Integrated constructed wetland visualisation at Clifton Sewage Works

manufacture, regional transportation, increased sludge production, for example. It also introduces operational complexity and significant cost to, otherwise, very basic works.

ICWs for treatment have been around for decades but due to footprint and perhaps more efficient sanitary load reduction processes they have fallen out of favour. The combination of the financial and environmental costs of nutrient removal, along with the growing political desire to promote nature-based solutions and societal awareness of biodiversity, wellbeing and circular economy provide reasons for change.

To this end Yorkshire Water, the Environment Agency and Stantec are working together to regulate (via an OTA), design, install and operate an Integrated Constructed Wetland ICW at Clifton Sewage Works. The ICW concept is based upon blending open water ponds with shallow vegetated marshes to closely resemble a natural wetland but also simulate the physical, chemical, and biological treatment processes which occur simultaneously in this environment. The ICW will undergo enhanced monitoring over a three-year trial period covered by the OTA.

### Why change – Housing Development?

The 2018 test case heard in the European court referred to as the "Dutch Case" has led to Natural England advising that no planning consents should be granted within the affected region unless they can demonstrate Nutrient Neutrality.

Developers are required to submit evidence that their proposal is nutrient neutral through the submission of a nutrient budget:

$$\begin{aligned} & \text{Nutrient loading post-development (sewage} \\ & \quad \text{+ infiltration/runoff)} \\ & \quad \text{MINUS} \\ & \text{Nutrient loading pre-development} \\ & \quad \text{(infiltration/runoff)} \\ & \quad \text{EQUALS} \\ & \text{Mitigation measures required} \end{aligned}$$

Mitigation measures include: reducing the sewage loading through on-site treatment, offsetting agricultural loading through taking land out of production or installing constructed wetlands to treat stream/river water.

Although wetlands are perhaps an obvious answer to nutrient neutrality, they require the right conditions. This may not be available within the red line boundary of a development. Blending engineering performance with the wider "integrated"

benefits of an ICW requires ambition, imagination, learning and for parties to work together in new ways.

Regulation can be a powerful agent for change, and it is through nutrient neutrality and a pragmatic permitting approach that we will be able to recognise ICW's long-term, multifaceted benefits for all society.

We are in a period of growing interest in, and ambition for, low carbon sustainable solutions to environmental problems - such as, wetlands and catchment management approaches. It will take time to complete the journey and there are many elements that need to be considered:

- environmental regulatory and permitting issues to be resolved,
  - technical understanding to be gained,
  - further development of capital accounting methodologies,
  - economic structures and incentives to be developed
- and the hardest one of all:
- new ways of thinking and working

The industry and environmental regulators need to embrace these opportunities and develop the skill, knowledge and experience to deliver natural performance.

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