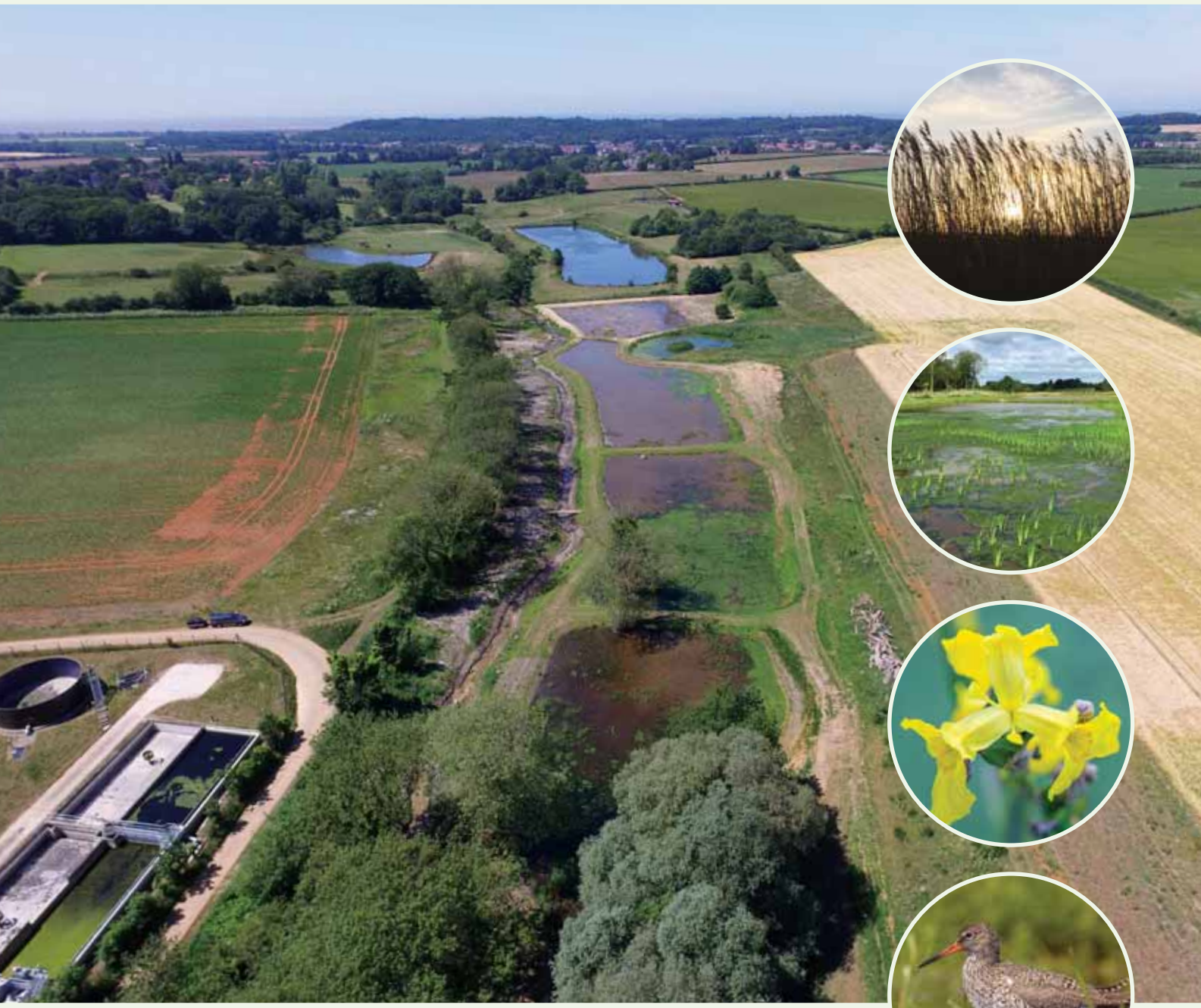
RIVER INGOL **WETLAND CREATION**

A partnership to benefit all



NORFOLK RIVERS TRUST

William Morfoot
Land Drainage & Project Management

The quality of water flowing down the River Ingol is of prime importance

As it meanders through the beautifully scenic North Norfolk landscape, the River Ingol might only be 10.4 km in length, but this belies its importance to the wider environment.

THE RIVER INGOL – A rare chalk river

Revitalising water quality

The River Ingol is one of only 200 chalk rivers and streams in the world, providing an extremely rare habitat for a diverse group of plants and wildlife. Chalk rivers derive most of their flow from chalk-fed groundwater. The 'classic' chalk stream has characteristics of alkaline, crystal clear water, which flows consistently over chalk or clean gravel beds.

In addition, the course of the river runs very close to the Norfolk coast – an area of international natural importance, owing to the habitats it provides to migrating birds and breeding waders, many of them endangered, or rare species. The mouth of the River Ingol enters the sea close to the Snettisham RSPB Nature Reserve.

All of this makes the quality of water flowing down the River Ingol of prime importance. However, scientific studies by the Environment Agency were showing that water quality in the Ingol had deteriorated downstream of the outlet from the Anglian Water recycling centre at Ingoldisthorpe.

Armed with the data from the Environment Agency, Anglian Water were extremely keen to be proactive in developing a solution to enhance water quality in the River Ingol.

Anglian Water explored a number of options, including using expensive, high-carbon treatment equipment, or pumping the water away for treatrment elsewhere.

However, they eventually decided on an alternative solution; the creation of a natural wetland, adjacent to the River Ingol, to naturally filter the water downstream from the Anglian Water site. When the possibility of a non-invasive wetland solution to improve water quality was raised, Anglian Water sought the assistance of the Norfolk Rivers Trust to assess the feasibility and consequences of such a scheme.

Following a full assessment of the proposed project's viability, in terms of delivering the required improvements to the water quality in the River Ingol, alongside full budgetary analysis, the River Ingol Wetland Project was given the green light to proceed.

A true partnership

The project was entirely funded by Anglian Water as part of their strategic commitment to improve water quality in affected rivers. With extensive previous experience in the creation of wetland projects, land drainage and environmental experts William Morfoot partnered with the Norfolk Rivers Trust to deliver the project for Anglian Water.

Following a full project-planning process, involving not only Anglian Water, Norfolk Rivers Trust and William Morfoot, but also local landowner James Wilson, the project began in the autumn of 2017 and was completed in spring 2018.

Wetland CREATION

A natural solution to an unnatural problem

The creation of a wetland to filter and improve water quality is not new thinking, but it represents a truly innovative solution to the problems faced by the River Ingol.

Wetlands are used all over the world as a natural way of treating and enhancing water quality, and William Morfoot has been involved in land drainage and wetland projects in the UK for over 50 years.

The principal is also very simple; an entire site is set up, so that the poor-quality water drains through a sequence of naturally planted pools, which successively filter out the undesirable elements within the water. Once the process is completed, the 'cleaned' water then flows out from the final pool and continues its journey.

The creation of a wetland to filter and improve water quality represents a truly innovative solution

The River Ingol Wetland Project

The site at Ingoldisthorpe lent itself towards a project such as this – the area being low lying and wet already, and set in a valley bottom, making it unsuitable for arable crop production. The woodland present on the proposed site had also been badly affected by ash dieback fungal disease, and many of the remaining trees within it were infected.

- **The River Ingol Wetland Project comprises four 'cells'** – which are essentially ponds.
- **Each cell is planted up with aquatic plants** – carefully selected by Norfolk Rivers Trust – which grow within the wetland.
- **The selected plants are native to the delicate chalk stream valley in which they grow** – these include iris, sedges, rushes, marsh marigold and watercress.
- **The water from the Anglian Water Recycling Centre flows into the wetland zone** – via a newly installed pipe, connecting the treatment plant directly to the wetland.
- **The water then discharges into the wetland** – flowing through each cell in turn.
- **The water is slowly filtered** by the plants, which remove undesirable properties – in this case, phosphate and ammonia – from the water, as the water flows through each cell.
- **By the time the water exits the final cell, the water quality is dramatically improved** – it can then flow from this cell directly back into the River Ingol.

Delivering THE PROJECT

Getting the timing right in challenging conditions

Although funded by Anglian Water, the project was managed by Norfolk Rivers Trust and delivered by William Morfoot – working to a strict timetable – to ensure that the required planting could take place at the right time of year, so enabling the crucial plants to be in the wetland in time to thrive in the spring.

Although the science and thinking behind the project was both viable and sound, it required an enormous amount of work, energy and skill to deliver the solution:

- **Specialist plant and machinery from William Morfoot's fleet was required, including the use of ultra-low ground pressure equipment, designed for use on saturated land.**
- **An experienced, highly-skilled team worked in waterlogged conditions where the cells were to be built.**
- **In addition, difficult and highly variable soil types made for challenging working conditions.**
- **William Morfoot's GPS surveying equipment and specialist wetland software was used to survey and adjust the design of the site, as it took shape and developed.**

The project was delivered in four distinct, but connected phases:

Phase 1 – Site/tree clearance

- **Despite the ravages of ash dieback**, the initial works involved felling the trees on site and clearing the site of other obstacles.
- **Trees needed to be felled** and transported out from within the wetland site – no easy task given the nature of the saturated soils at that time of year!

Phase 2 – River diversion

- **In order to ensure that the project delivered** the necessary improvements in water quality, through the cell system, the River Ingol was required to have its course altered.
- **The new line of the river** was positioned away from the site of the new wetland – providing segregation between the watercourse and the lower quality water entering the wetland.
- **The William Morfoot Team** then carefully crafted this new line for the river to follow, creating natural curves and meanders to mimic a naturally occurring river, and to enhance the habitat available to wildlife who would make this their home.

Phase 3 – Cell creation

- **The creation of the four cells** was a major earthworks project, requiring a significant level of cut-out spoil from within the proposed areas where the cells were being built.
- **This mammoth digging exercise** was conducted throughout the highly-challenging weather conditions, caused by the exceptionally wet conditions of winter 2017/2018.
- **GPS technology was used** to cut the cells to very precise levels – to create the correct rate of water flowing slowly through the cells.
- **The edges of each cell were carefully created** with gradually sloped banks, including significant variations in the alignment, specifically to construct an ideal habitat for birds and other wildlife to live and thrive.

Phase 4 – Pipework connection

- **The final phase** saw the installation of a new feed, to pipe the water supply from the Anglian Water recycling plant into the new River Ingol wetland.
- **A new spillway** was also installed at the inlet to the wetland, to prevent erosion to the banks and to disperse and slow the flow of water as it entered into the cells.
- **This feed had to be installed** over the top of the River Ingol.
- **Each cell was then interconnected** by large diameter pipes – with each pipe carefully set at exactly the required level to control water heights and flow.

Benefits FOR ALL

Community experience and opportunity

A real-life example of how developing new wetland habitats can both improve water management and deliver a high bio-diversity impact

All stakeholders in this innovative project are keen that it should not just be of benefit to the wildlife which inhabit the river and the new wetland, but that it also provides a wider benefit to the local community.

The site of the new wetland is adjacent to a footpath which is regularly used by locals and visitors to the area. The footpath provides an ideal opportunity for members of the public to experience the sights and sounds of this special place for themselves.

The finished project is proving a very helpful tool as a learning/research facility, demonstrating a real-life example of how developing new wetland habitats can both improve water management and deliver a high bio-diversity impact.

Young school children have already been actively involved by helping to plant the wetland with the new wetland plants.

Norfolk Rivers Trust has also been introducing students from the UEA and other higher education facilities to the site – to learn more about what is being done.

In addition, it was always intended that the site should be utilised as a flagship project, to promote the idea of wetland construction as a natural method of improving water for use in other projects around Norfolk. Norfolk Rivers Trust is constantly monitoring the water quality at the River Ingol site, so that the achieved levels of water quality can be used as a case study example for other prospective sites.

Improving WATER QUALITY

Partnership and commitment

> *We want this type of scheme to become more commonplace as a water treatment option in the future.*
>
> Regan Harris, Anglian Water plc

The fact that this project was even contemplated, let alone planned, funded, commissioned and delivered, is a testament to the commitment that all parties made wholeheartedly to the project.

Environment Agency

The Environment Agency's role, in this context, is to monitor and assess water quality at strategic locations in watercourses throughout the UK.

If issues are detected, the Environment Agency is committed to a collaborative approach, working with the other stakeholders to return water quality to acceptable levels.

Following the discovery of increased levels of phosphate and ammonia, in the River Ingol, the Environment Agency has worked with Anglian Water, Norfolk Rivers Trust and William Morfoot, to play a key role in this project from start to finish.

Steve Hopper, Environment Planning Specialist at the Environment Agency, elaborates: "To successfully deliver the River Ingol Wetland as a treatment option, needed all parties involved to change their established thinking around environmental improvement and the frameworks for permitting wastewater discharges.

"With compromise and understanding by all parties, we now have a fantastic alternative solution that will deliver much wider environmental benefits than traditional treatment technologies. It's an outcome that many of us have been aspiring to deliver for some time.

"I hope that all the work we have done to deliver the River Ingol Wetland, and the evidence we are gathering to demonstrate the wider environmental outcomes, will give confidence that similar solutions can be delivered in other suitable locations."

> *Without the cooperation, understanding and pragmatic approach of the Environment Agency, we would never have been able to complete this groundbreaking system.*
>
> Dr Jonah Tosney, Operations Director, Norfolk Rivers Trust

love every drop anglianwater

Anglian Water is committed to improving water quality throughout its operating network. Following the successful completion of a feasibility study by Norfolk Rivers Trust, the company embraced the possibility of using a natural filtration solution for its site – provided by the construction of a wetland – and chose to fund the River Ingol Wetland Project.

Regan Harris, from Anglian Water plc, comments: "This is a really exciting project to be involved in and a first for any water company in England. Wetland treatment sites such as this enable us to treat used water to the same high standards as our conventional sites, while vastly reducing our carbon footprint, costs and, most importantly, enhancing the local environment and ecosystems.

"Chemicals like phosphates and ammonia come from urbanisation, domestic products like detergents, as well as from human and animal waste. We need to find more natural ways to treat them rather than adding more and more chemicals in our treatment processes, which is unsustainable. So the wetland is a great solution.

"It's excellent for biodiversity, and does this job for us naturally. We want this type of scheme to become more commonplace as a water treatment option in the future as it's an excellent example of how by working together, we can provide innovative solutions for our treatment processes, ensure they are sustainable for future generations and protect the environment."

Norfolk RIVERS TRUST

Aquatic conservation and restoration

> *These wetlands give us a fantastic opportunity to research many aspects of water, soil and environmental change affecting our use of water and river ecosystems.* David Diggens, CEO, Norfolk Rivers Trust

The Norfolk Rivers Trust (NRT) was established in 2011, with the objective of conserving and restoring Norfolk rivers and wetland habitats – by enhancing the value of the aquatic landscape, through encouraging natural processes.

The NRT's vision is to ensure that the quality of water provides the best habitat to benefit the people and wildlife that live within and around it.

The NRT achieves this by giving advice and working in partnership with a wide range of government and non-government bodies, and collaborating with farmers, landowners and the public, through its team of independent experienced ecologists and other specialist advisors.

The NRT are involved in the management and improvement of river systems and watercourses throughout Norfolk.

Previous projects have involved reviving choked and forgotten river systems, as well as revitalising highly important chalk rivers and streams, such as the River Ingol.

The River Ingol Wetland Project presented the NRT with a great opportunity to utilise its vast knowledge and expertise in watercourse management and river conservation.

From the NRT's perspective, the dual benefit provided made this project particularly stand out:

1. To enhance the water quality of water exiting the Anglian Water recycling works to meet Environment Agency standards, creating improved water quality flowing down the course of the River Ingol, thus safeguarding the unique ecosystems which exist around rare chalk streams.

2. To develop and create a brand new wetland habitat in a corner of Norfolk which already has international significance for rare birds, but is also of great importance because of the native species which grow in the rare and highly important chalk substrate.

David Diggens, CEO of Norfolk Rivers Trust, commented: "We are delighted with the delivery and cooperation of all those involved in this pioneering innovative nature enhancing project.

"We have already witnessed the positive change in species and know that water quality improvements will follow."

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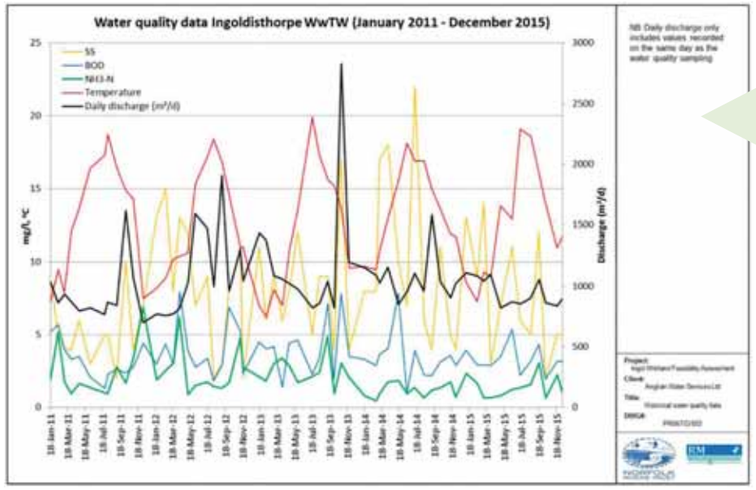
The SCIENCE

A natural solution



Science is at the very heart of the River Ingol Wetland Project; it was the scientific analysis of the Environment Agency, which revealed the rising levels of harmful properties in the water downstream of the Anglian Water recycling site, that brought about its creation.

Chemicals such as phosphates and ammonia come from rising urbanisation – from domestic products like detergents, as well as from human and animal waste – and are two of the most detrimental substances affecting water quality.

However, it is an age-old natural solution which is delivering the massive change in the scientific results collected by the Environment Agency at the site – the use of reed beds, sedges and other planting solutions is not a new development, they are in use at many sites around the globe.

The plants chosen by the Norfolk Rivers Trust to grow in the wetland absorb the phosphate and ammonia, cleansing the water as they do so. This simple, yet effective natural process is much cheaper than removing ammonia and phosphates through artificial means, while also having the added advantage of generating widespread benefits to the local ecosystem.

The Environment Agency have set tough standards for the quality of the water being returned to the River Ingol; just one milligram of ammonia per litre in addition to a phosphorus limit of 4.5 milligrams per litre. Early signs are that these standards are more than being met by the new River Ingol Wetland.

A landowner's PERSPECTIVE

Asset enhancement through nature

James Wilson is the owner of the land at Ingoldisthorpe, where the new wetland site has been built. His involvement in the River Ingol Wetland Project was pivotal in allowing it to proceed;

Acceptance that the ash dieback disease had infected a lot of the trees within the wetland site – meaning that regeneration, at least on some level, was inevitable.

> *"I feel that this plot of land is making a highly positive contribution to addressing some of today's environmental difficulties."*
>
> James Wilson, landowner (River Ingol Wetland site)

Enthusiasm for the development of nature and biodiversity alongside the river, and a strong desire to see the ideas and vision of the Norfolk Rivers Trust turned into a reality.

James is delighted with the success of the project: "When the Norfolk Rivers Trust approached me with the proposal for the wetland, I must admit that I was a little skeptical", he commented.

"However, once the project was underway, I could see from the professional manner of staff, from both William Morfoot and the Norfolk Rivers Trust, that the outcome would be of a very high standard.

"As an alternative land use, it has enhanced my landholding and created a beautiful asset, that is not only beneficial to nature, but also to the local community."

Project RESULTS

Biodiversity at its best

Although only completed in spring 2018, the early signs are that the project will be a great success.

The sounds of a diverse array of birds now greet visitors arriving at the site at any time of the day.

Water has filled the pools quickly; encouraging birds and local wildlife to start feeding in the shallow waters from day one.

Just weeks after the completion, the plants have already taken great steps forwards in growth – basking in the sunshine and warm spring temperatures. Insects and other invertebrates are buzzing all around the cell perimeters and within the ponds too, on the fast-growing plants and reeds.

Water has flowed constantly from the Anglian Water recycling facility and through the four cells – with the water quality already being recorded as being of vastly improved quality.

The newly-cut river channel now flows with crystal clear waters, and the new river banks are steadily developing new life thanks to the clever planting work carried out by the Norfolk Rivers Trust.

There have been a number of high profile visits to the site, with significant interest from other water authorities and like-minded organisations looking to replicate this kind of project within their own areas.

The site has been transformed from a dying woodland into something which is unquestionably beautiful, fully complimenting the stunning countryside of which it is now part.

The breathtaking views around the site have been enjoyed by scores of schoolchildren, students and members of the public who have an interest in the natural world.

It is hoped that the cells will provide the perfect habitat, in terms of both feeding and breeding, for a broad mix of wildlife for many years to come.

Project **LEGACY**

A beacon for others

Perhaps the greatest legacy of the River Ingol Wetland Project is that its success provides one of the strongest examples in the UK of how water quality can be improved through the use of a natural wetland.

The continuing pressure of housing/population growth means that there are ever-increasing demands being made on water recycling facilities in the UK. A number of other similar sites have already been identified, which face similar issues to those found at the River Ingol. The success of the River Ingol project paves the way for other similar projects to happen elsewhere in the UK.

The project also demonstrates the clear need for collaboration between a multitude of organisations – and, ultimately, how a complex and demanding project is possible when such organisations work together towards a common objective.

Society as a whole is becoming more aware of the need for environmental obligations to be met, resulting in a greater understanding about the need to protect and look after precious habitats. There is a rising expectation

One of the strongest examples in the UK of how water quality can be improved through the use of a natural wetland

The River Ingol Wetland Project is, literally, living proof that private, public and third sector organisations can collaborate successfully for the benefit of the natural environment, in this case:

- **Anglian Water**
  – Privately-owned utility company
- **Norfolk Rivers Trust**
  – Charitable NGO
- **Environment Agency**
  – Government agency
- **William Morfoot**
  – Privately-owned land drainage and wetland specialist

In addition, the River Ingol Wetland Project collaboration involved significant contributions from:

- **Ingoldisthorpe Primary School**
  – Local community
- **James Wilson**
  – Local landowner

to provide habitats to support rare and protected species of birds and wildlife – especially in places which are already regarded as being of international importance, such as North Norfolk.

What is unquestionable is that the River Ingol wetland has surpassed expectations in terms of water quality and, crucially, has delivered a spectacular natural environment in which wildlife can thrive – one that future generations can continue to enjoy for many years to come.

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