

Phosphorus Removal Programme

Anglian Water's £338m investment across 170 sites throughout AMP7 to mitigate the release of phosphates into the environment

by Anglian Water's @one Alliance

Anglian Water serves the East of England, a region that faces unique challenges due to its status as one of the driest areas in the UK. Anglian Water provides water and wastewater services to millions of residents and businesses, balancing the demands of a growing population with the need to protect vital environmental resources. Central to Anglian Water's AMP7 environmental strategy was a region-wide programme to mitigate the release of phosphates into the environment, ensuring the region's water ecosystems are safeguarded for future generations.



Ferrous chloride storage tank and new stormwater storage tank from Hayes GFS Ltd at Whaddon WRC - Courtesy of Anglian Water's @one Alliance

Background

As urbanisation and industrial activities expand, the demand for efficient wastewater treatment systems continues to rise. This creates mounting pressure on existing infrastructure to adapt and meet evolving environmental challenges.

By prioritising these innovative solutions and sustainable practices, Anglian Water is leading the way in maintaining a balance between environmental stewardship and operational efficiency.

The AMP7 Phosphorus Removal Programme involved a £338m investment spread across 170 targeted projects throughout the Anglian Water region, which not only ensured compliance with stringent environmental standards, but also supported habitats by significantly improving the quality of treated wastewater.

The issue

Phosphorus, a naturally occurring nutrient often present in wastewater, poses a significant environmental threat when discharged into water bodies at high concentrations. In excessive amounts, it drives eutrophication - a process that promotes rapid algae growth, depletes oxygen levels in the water, and jeopardises aquatic life. Recognising the severe risks of eutrophication, the Environmental Permitting Regulations (EPR) enforce stringent

limits on phosphorus concentrations in treated wastewater to protect water quality.

Through rigorous monitoring and testing, Anglian Water identified several sites within the region that were at risk of non-compliance with these stringent limits, particularly for phosphorus levels below 0.5 mg/l. Existing treatment processes at these sites were unable to consistently achieve the required reductions, leaving the Water Recycling Centre's (WRC) vulnerable to environmental penalties, regulatory scrutiny and reputational risks.

To tackle these challenges head-on and ensure compliance with its AMP7 obligations, Anglian Water set its strategic delivery partner, the Anglian Water @one Alliance, with designing and implementing a comprehensive phosphorus removal upgrade programme. This large-scale initiative aimed to modernise treatment systems, enhance operational resilience, and support the long-term health of the region's aquatic ecosystems.

The solution

To meet the regulatory requirements and improve phosphorus removal efficiency, a carefully designed solution was developed for each of the 170 projects around the region from the Anglian Water's @one Alliance.

The programme focuses on installing new infrastructure and upgrading existing systems, ensuring all water recycling centres can meet the required phosphorus discharge limits of less than 0.25 mg/l. Each site required slightly differing solution phases in terms of project timings, equipment, installation phases and investment figures, however by utilising a consistent approach across schemes, effective resource management was enhanced.

Improved mixing and screens: On some projects which had the standard equipment installed, it was felt that once optimised, performance could be better. Improvements were made to the chemical mixing at the Point of Application (POA), using various systems including vanes and turbulence enhancement and the introduction of aeration. When the existing effluent screenage was inadequate for the enhancement, finer screens were installed where required.

Electrical infrastructure upgrades: Many of the project's required essential upgrade to the Distribution Network Operator (DNO) infrastructure. These required a new pole-mounted transformer and a DNO kiosk to be installed to support the increased electrical demand of the new treatment systems for many years to come.

Chemical dosing systems: The project teams identified the need for many ferrous chloride storage tanks to be installed alongside some associated instrumentation. These tanks are pivotal to provide precise chemical dosing to facilitate phosphorus removal through chemical precipitation in the Water Recycling Centres. This system also included a dedicated control panel, dosing pumps, two points of application (POAs), and isolation valves to ensure operational reliability.

Sludge handling enhancements: As part of the delivery of this huge programme, some of the projects required a new auto-desludge system to be introduced to the primary settlement tanks (PSTs). This system incorporates automated plug valves within the gravity flow sludge line, to enable the efficient and automated sludge removal to occur, reducing operator intervention and enhancing process consistency.

Tertiary treatment systems: Many of the projects required either new or modifications to the tertiary treatment process to enhance the site's ability to handle the phosphorus removal. This system includes wet well and pumping station modifications to ensure wastewater flows effectively into the new treatment units.

The installation of the tertiary cloth filter with mixing and flocculation tanks provided advanced treatment to achieve the stringent phosphorus limits. This process enhances particle capture and ensures optimal phosphorus removal efficiency.

Some of the projects required new backwash return pumps to return backwash water to the head of the works; minimising the waste and ensuring sustainable operation.

Lighting and accessibility improvements: To support many of the new systems, additional lighting has been added to tanker delivery points and fill panels. This ensures the Anglian Water operational teams can complete their works safely, especially during low-light conditions.

Control and automation: A fully integrated control system was introduced to manage the new processes. New kiosks were installed to house the control panels and actuators were added for seamless automation. The system interfaces with existing site controls, providing Anglian Water operators with real-time monitoring and streamlined operation.

All of the above equipment solutions were determined at the front end of the programme of works and standardised. This resulted in

Anglian Water's AMP 7 Phosphorus Removal Programme Supply chain - key participants

- **Project delivery:** @one Alliance
- **MEICA:** Glasswell & Last Ltd | AVRS Systems | Kemada Project & Contract Services Ltd | Ross-shire Engineering | Dodd Group
- **Tertiary treatment package suppliers:** ATAC Solutions Ltd | Eliquo Hydrex Ltd | FLI Water
- **MCC suppliers:** Paktronic Engineering Co Ltd | TES Group | CEMA Ltd
- **Pump skids:** Waveney's
- **Pump suppliers:** NOV | Gorman Rupp
- **Valves & penstocks:** AVK UK Ltd
- **Instruments:** ABB Ltd
- **Chemical dosing tanks:** Forbes Technologies | EPS Water | Lintott Control Systems
- **Emergency showers:** Hughes Safety Showers



great efficiency through design and procurement with repeatable assemblies on site and consistency with AW Operations. The standard designs allowed all scope to be detailed with a 'selection box' approach which meant the standard Control Philosophy, P&IDs, FDS was adaptable for each scheme. In the best case scenarios, the teams were site-ready with design just 12 weeks after the need was identified, which enabled bulk procurement of standard equipment.

Benefits of the solution

The vital upgrades to in the Phosphorus Removal Programme deliver many environmental, operational, and regulatory benefits.

Regulatory compliance & environmental protection: The delivery of these projects will make sure the WRC's are compliant with stringent discharge limits (less than 0.25 mg/L). These limits have been put in place to protect the water quality and minimising the risks of eutrophication in our local water bodies.

These improvements support biodiversity and maintain clean waterways while meeting EPR and AMP7 obligations.

Operational efficiency & cost-effectiveness: Introducing these automated systems, like auto-desludging and tertiary treatment units, will enhance the teams process consistency by reducing the need for manual intervention. Through integrating features such as backwash return pumps and scalable chemical dosing systems this lowers are lowering operational costs and enabling adaptability for future challenges.

Safety, accessibility & long-term sustainability: By providing these key infrastructure upgrades, including better lighting, access paths, and control kiosks, these all play a vital part in enhancing the safety and maintenance capabilities required from the Anglian Water operation team. The design has been future-proofed to ensure

resilience to regulatory changes, population growth, and other challenges beyond 2025 has been provided.

Community confidence & stakeholder engagement: By meeting environmental obligations and the proactive approach to sustainability, this extensive programme increases Anglian Water's trust with regulatory bodies, local communities, and environmental organisations. This reinforces the great work that has been provided as a responsible and environmental focused organisation.

Summary

Overall, the £338m Phosphorus Removal Programme marks a significant forward-thinking approach in meeting the challenges of modern wastewater management. By installing advanced treatment systems, upgrading existing infrastructure, and optimising current processes, Anglian Water have not only achieved compliance with stringent environmental regulations but also delivering meaningful benefits to local communities and ecosystems.

This case study underscores the value of forward-thinking, standardisation and collaboration in addressing complex environmental issues. It stands as a testament to the success of our teams and serves as a benchmark for similar initiatives, showcasing how proactive investments in infrastructure can drive lasting benefits for both our customers and the environment.

The editor and publishers would like to thank Anglian Water's @one Alliance for providing the above article for publication.

The @one Alliance is a collaboration of eight partner companies that each provide specialist knowledge allowing the Alliance to deliver complex delivery projects in the most efficient way, reducing the cost to Anglian Water's customers. The partners are Anglian Water Asset Delivery, Balfour Beatty, Barhale, Binnies, Mott MacDonald Bentley, Sweco, Skanska, and MWH Treatment.

