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Knostrop Wastewater Treatment Works

Xylem CoMag helps Yorkshire Water exceed phosphorous targets

Treating 75% of full flow to treatment, the CoMag® system delivers 0.25mg/l phosphorus—well below regulatory limits

The challenge

Knostrop Wastewater Treatment Works (WwTW) is Yorkshire Water's largest treatment site, serving a population equivalent of 990,000 in and around the city of Leeds, with a full flow to treatment of 5,600l/s.

Due to a projected population increase, discharges from the site were required to undergo advanced biological treatment to reduce levels of phosphorous returned to the River Aire. This requirement was part of the UK Environment Agency's Water Industry National Environment Programme (WINEP).

The Aire flows 148km from the Yorkshire Dales to the River Ouse, with a catchment that encompasses 22 Sites of Special Scientific Interest (SSSI), four Special Areas of Conservation (SACs) and two Special Protection Areas (SPAs).

High levels of phosphorus in watercourses trigger algal blooms, which consume oxygen and damage ecosystems. To help combat the blooms, the WINEP is imposing lower phosphorus limits on many wastewater treatment plants in England.

Customer
Yorkshire Water

Challenge
To reduce phosphorus discharges to 0.4mg/l at Knostrop WwTW through advanced biological treatment.

Solution
CoMag® ballasted clarification system—a magnetite-based solution for enhanced tertiary treatment.

Project results
Exceeding phosphorus targets with 0.25mg/l across 75% of full flow to treatment.

Knostrop's new compliance level was set at 0.4mg/l total phosphorus. To achieve this, in 2023 Yorkshire Water began a £60m upgrade of the site, implementing a range of advanced treatment technology from solutions providers including Xylem.

The solution

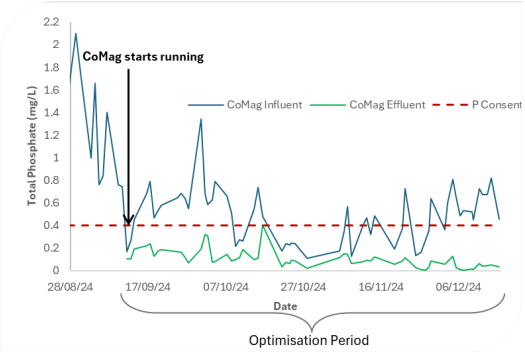
A CoMag® ballasted clarification system was installed to provide a new tertiary solids removal process, as part of the wider upgrade at Knostrop WwTW.

Unique to Xylem, the CoMag process reduces phosphorus through the addition of magnetite - a high density naturally occurring mineral, which increases the weight of conventional precipitated floc. Magnetite easily embeds into the floc and results in the accelerated solid settlement – up to 10 times faster than conventional methods.

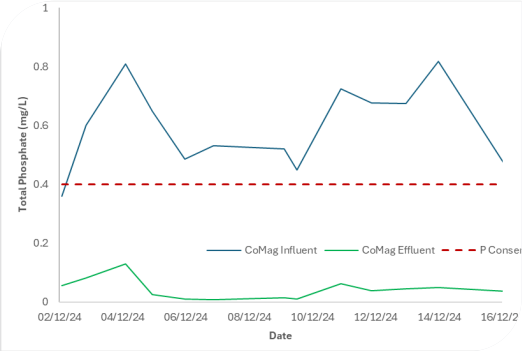
As part of the CoMag process, sludge is recycled and passed through a magnetic drum, which continuously recovers most of the magnetite, resulting in more sustainable treatment and lower operational expenditure. The technology is fully automated, requiring minimal ongoing operational input.

Thanks to significantly faster settlement, the CoMag clarifier can be much smaller than conventional final settlement tanks. This not only makes it more space-efficient, but also enhances overall process efficiency, enabling high-performance treatment in a more compact footprint.

Due to the efficiency of the process, just one 32m high-rate CoMag clarifier was required at Knostrop WwTW.



Total Phosphate results during the optimisation process.



Total Phosphate measurements during performance test period.

> "We can now confidently fulfil and surpass our commitments to reduce phosphorus at our Knostrop STW, while meeting our cost and ongoing operational objectives."

Sam Akeroyd, Capital Delivery Programme Manager, Yorkshire Water

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Results

Following commissioning in September 2024, Knostrop's CoMag system provides tertiary solids removal to 75% of the site's full flow to treatment, helping achieve average total phosphorous of 0.25mg/l – exceeding the target of 0.4mg/l. The results were immediate and the ultra-low level of 0.1mg/l was recorded during the performance test period.

The required surface area to treat the same volumes - 75% of the site's FFT - in a traditional final settlement tank is 14,136m2, compared to the 804m2 for CoMag.

Duncan Wildgoose, Xylem's Business Development Manager, Treatment said: "Xylem is proud that its CoMag system was chosen for Yorkshire Water's Knostrop upgrade. The technology is processing a significant treatment flow, boosts treatment capacity and improves the tertiary filtration—while using less space than conventional methods.

"The benefits to the River Aire ecosystem were quickly observed, due to the efficiency and speed of the CoMag process. Importantly for Yorkshire Water, the innovative technology continuously recovers most of the magnetite, which will support the plant's sustainability requirements and budget."

Following the success at Knostrop, Yorkshire Water has selected CoMag technology for another large site requiring phosphorous removal.

> "The CoMag system from Xylem has provided Yorkshire Water with a stand-out solution for reducing phosphorus levels to meet new environmental consents."
>
> Sam Akeroyd, Capital Delivery Programme Manager, Yorkshire Water

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