

## SUMMARY

## Challenge

Reduce energy, improve compliance

## Solution

Multivariable control of oxidation ditch

## Results

Energy reduced, control & compliance improved

United Utilities provides water and sewerage services to over 7 million people and over 200,00 businesses in the north-west of England.

One of their sites employs **Orbal oxidation ditches** for nutrient removal. This design uses brush aerators and is considered energy-intensive and difficult to control.

Following success at other sites, Perceptive Engineering was asked to assess the Orbal process. The key objectives were: to identify opportunities for reducing energy; improving control during peak tariff and triad periods; deploy new instrumentation (Redox ORP) to maximise efficiency and reliability.

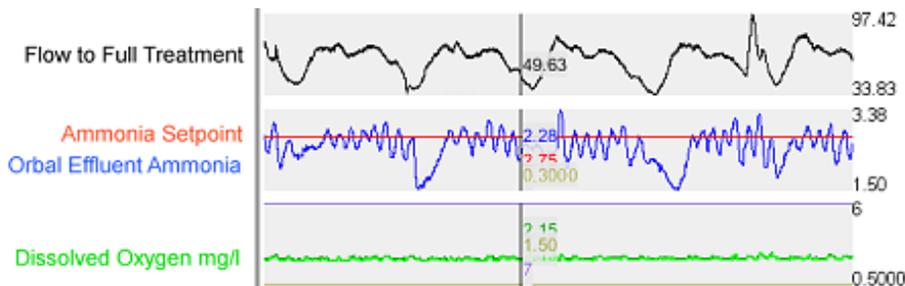
## PERCEPTIVE AUDIT

Several key opportunities for optimisation were identified: predictive control of aeration in the Orbal process and the MLSS levels in the secondary stage, could provide a **minimum 10% reduction in aeration energy**. Managing peak tariffs and triad periods would offer further reductions to the cost of bought-in energy.

## RESULTS

Perceptive Engineering implemented three distinct phases of advanced control at this site. The first stage required a data-driven model to be developed of the aeration system. This allowed us to implement multivariable control of dissolved oxygen levels, providing far tighter control. Aeration could then be closely matched to incoming load, leading to more efficient removal of ammonia in the Orbals.

This first phase achieved **energy savings in excess of 20%**.



United Utilities and Perceptive Engineering identified an opportunity for further savings, by using ORP (redox) probes and optimizing the MLSS levels in the Orbal stage. In doing so, an **additional 4% of aeration energy was saved**, without compromising the quality of treated water.

Finally, a system was developed to manage peak tariff periods, reducing energy consumption when the cost of electricity is at its highest. The system automatically 'over treats' the inlet ahead of a peak cost period, to ensure compliance throughout. Operation of the Orbals was stabilized to provide the optimal balance of aeration for simultaneous nitrification and denitrification.

The combined energy and cost reduction equated to **annual savings in excess of £200,000**.

"The project completed by Perceptive Engineering has successfully shown that significant reductions in electricity consumption can be achieved, through the novel use of statistical monitoring and model-based control."

*Dr. Sarah Needham, Asset Standards and Innovation, United Utilities*