Introduction

By 2025, half of the world’s population will be living in water-stressed areas and according to the World Economic Forum, water crisis is the third highest global risk. We all have a responsibility to lead sustainable water use and wastewater treatment.

Water companies need to comply with stringent regulations, reduce unplanned supply interruptions, lower operating costs and decrease ground water depletion and contamination.

In the digital age, information is increasingly recognised as an organisation’s most critical and differentiating asset. Water companies collect and store large amounts of data about the status and behaviour of their infrastructure, however it remains largely underutilised.

Predictive analytics can enable better decision making alongside a shift from reactive, inefficient maintenance to a proactive approach, cutting costs and improving performance.

Background and business challenge

Wastewater networks are extensive and complex. Pumping stations, treatment works and sewers are prone to failures requiring emergency attention by teams of operators with heavy equipment. There is a high associated cost of maintenance and fines from regulators, alongside damage to company reputation and the environment.

To try to prevent failure, water companies have experimented with the introduction of scheduled maintenance regimes, however these tend to be prohibitively expensive. Furthermore, they are undermined by the inherent unreliability of asset and maintenance records. Another approach has been to attempt to monitor assets more closely by fitting additional flow, energy or vibration meters. As well as being costly, this only contributes to the overload of signals and alarms reaching operators and engineers.

Supervisory control and data acquisition (SCADA) systems already produce too many telemetry readings and alarms for individuals to monitor effectively. Moreover, individual signal readings have high variability and uncertainty, making interpretation difficult.

Valuable insights buried in these volumes and varieties of data, sometimes termed Big Data, are frequently overlooked for several reasons. One of the main reasons relates to cost. Many Big Data technologies have been expensive to implement for water companies faced with ever-tightening budgets.

Solution

Hitachi Consulting has been leading enterprises through adoption of Business Intelligence and data analytics technologies and practices over two decades. Big Data and analytics drive insight and fuel innovation, enabling organisations to leverage the intrinsic value of their data. Our business insights and analytics capabilities include a full range of services, from strategy through to deployment, focused on data science, visualisation, IoT, cloud, mobility and technology convergence.

Hitachi Consulting UK, in partnership with the Hitachi Global Centre for Innovative Analytics, co-created with UK water companies algorithms capable of cross-referencing suites of historic telemetry signals from each wastewater site. Powerful real-time mathematical processing strips away SCADA noise to illuminate the true behaviour of assets and processes for the first time.

Examination of standard SCADA signal history sampled at 15 or 30 minute intervals (Figure 1) allows a statistical profile of ‘normal’ behaviour to be built, enabling anomaly detection. More importantly, key features such as pump flow rate and energy efficiency can be derived from combinations of signals then used to highlight risky situations.

![Figure 1 - Waste Water Telemetry](image)
Predictive Maintenance for Wastewater Management

The wastewater predictive maintenance tools are built on the Hitachi water analytics platform which comprises data ingestion & transformation, storage, data science algorithms, stream processing and interactive dashboards running within a Big Data platform which is typically hosted in the cloud but can also be operated within a company data centre. Figure 2 shows the primary features of the architecture, which can additionally be expanded to incorporate new components as needed. The platform is open and designed to be accessible for water company IT staff, analysts and data scientists to create their own modules, dashboards and insight. The platform can also feed data into existing Business Intelligence or operational systems, either in the cloud or data centre.

Benefits

Results from field trials indicate that the cost of pump station maintenance can be reduced by 20 to 40% through the introduction of a targeted and timely regime based on Artificial Intelligence. For example, the system can identify partially blocked pumps or those approaching end-of-life to a 90% accuracy rate.

Around 30% of pollution incidents are caused by pump failure and results indicate that at least half of these can be prevented by targeted maintenance. Additionally, a further 40% of incidents are caused by blockages – a proportion of these can also be detected by Artificial Intelligence, allowing proactive and targeted maintenance.

Additional savings in electricity usage are achieved through more efficient operation of pumps.

The system also highlights risk hotspots in the wastewater network, allowing operators to identify potential bad outcomes caused by incorrect operation or an adverse environment. By taking remedial action early, water companies can further reduce both the number of pollution incidents and their severity, minimising environmental impact and potential regulatory fines.

Why Hitachi Consulting

Hitachi Consulting is the global solutions and professional services organization within Hitachi Ltd., a global innovation leader in industrial and information technology solutions and an early pioneer of the Internet of Things. Hitachi Consulting is a business integrator for the IoT era and a catalyst for digital transformation. Using our deep domain knowledge, we collaborate with clients to help them innovate faster, maximize operational efficiency and realize measurable, sustainable business and societal value. As a consulting-led solutions company, we can help you leverage data as a strategic asset to drive competitive differentiation, customer loyalty and growth.

Hitachi Consulting is a large, independent management consultancy with a holistic approach to delivering innovative solutions that drive business improvement and deliver long-term sustainable advantage.

Hitachi delivers a full spectrum of water management solutions, from water quality, treatment and distribution to wastewater management, analytics and compliance solutions. We integrate consulting, engineering and equipment with global experience. We are committed to delivering innovations that answer society’s water challenges and helping water utilities meet their water management goals.

For more information on Hitachi’s Predictive Maintenance for Wastewater Management please contact learnmore@hitachiconsulting.com

Figure 2 - Solution Architecture