

Upgrading the UK's hidden assets

How digital engineering is revitalising water
infrastructure



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Water infrastructure is often referred to as the UK’s “hidden” asset base – comprising millions of miles of pipes, pumps, and treatment facilities that operate out of sight. Every day, almost 70 million people rely on these systems for safe drinking water and sanitation.

Yet parts of this infrastructure are ageing and increasingly strained by challenges including population growth, climate change and ever-stricter environmental standards. Adding to that is increased demand from a diverse range of businesses, including agriculture, food production, hospitality, chemicals and cloud data centres. Today, the sector faces intense public scrutiny over pollution and service failures.

The next regulatory period, AMP8 (2025-30), unlocks a record £104 billion of allowed expenditure – a 50% increase on AMP7 – but is also set to drive a 36% average rise in bills by 2030. That funding must therefore deliver step-change value, or public trust will deteriorate further.

Digital engineering – data-rich, model-based working across the asset life cycle – is the most credible way to square the circle of increased investment, tougher outcomes, and affordable bills. In this whitepaper, we outline the status quo, the pressing need for digitalisation in the context of AMP8, and the way forward for the UK water sector.

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01 - Challenges facing the sector

Most people never see the infrastructure that delivers safe drinking water and removes wastewater. Yet across England and Wales, there are:

- 345 000 km of water mains
- 500 000 km of public sewers
- 1,041 water-treatment works (WTWs)
- around 4,000 wastewater-treatment works (WwTWs)
- more than 40,000 pumping stations
- hundreds of reservoirs, aqueducts and strategic trunk mains

Together they serve 57 million customers and underpin £170 billion of economic output each year. But performance is sliding. Between 2020 and 2024, the industry:

- cut leakage by only 6 % against a 16 % target
- reduced combined sewer overflows by just 2 % against a 30 % target
- incurred net customer penalties of £158 million
- saw no company graded “leading” by Ofwat; three were deemed “lagging”

At the same time, external pressures are rising:

**Population growth:**
England’s population is forecast to rise by 6 million by 2040.

**Climate volatility:**
Hotter, drier summers punctuated by intense rainfall.

**Tightening environmental standards:**
Nutrient permits, bathing-water ambitions, biodiversity net-gain duties.

**Net-zero commitments:**
The sector must reach operational net-zero by 2030 and full value-chain net-zero by 2050.

“Money alone will not bring the sustained improvements that customers rightly expect. It is clear that companies need to change, and that has to start with addressing issues of culture and leadership.”

David Black – Chief Executive, Ofwat



02 - The ageing asset base

Each of the following asset types represents a huge capital base built over decades. Maintaining and enhancing these “hidden assets” is a complex, costly endeavour – but also one ripe for innovation.

Asset	Scale	Emerging issues
Water-treatment works	1,041	Ageing media filters, chemical usage, and high energy demand.
Wastewater-treatment works	~4 000	Tighter phosphorus and ammonia controls, storm resilience.
Pumping stations	> 40,000	Failures drive 93 % of serious incidents; large energy draw.
Reservoirs & raw-water transfers	570 impounding reservoirs; > 30 major aqueducts	New storage and inter-region connectivity are needed for drought.
Distribution mains	> 345,000 km	Leakage c.1 trillion litres per year!; variable pressure.
Sewer network & CSOs	> 500,000 km	Pollution under scrutiny; Victorian combined sewers exceed capacity.

Missing data?

Up to 70% of asset records are incomplete or out-of-date. Paper drawings and reactive maintenance leave value on the table. Digital engineering closes the knowledge gap.

03 - Regulatory drivers – what AMP8 demands

Every five years, Ofwat sets price controls and performance targets in an Asset Management Period (AMP).

AMP8 (2025–2030) is set to be a transformative period for UK water, following AMP7’s ~£51bn spend. After pruning and review, Ofwat’s final determinations allow about £104bn² of expenditure – the largest ever – to reverse underinvestment, meet tighter environmental standards, and build resilience.

Key investments include £12bn to cut storm overflow spills, ~£6bn for wastewater treatment upgrades, £3.3bn for nature-based and biodiversity projects, and major new water resources (at least nine reservoirs and inter-regional transfers) to improve drought resilience.

The drivers are external mandates: the Environment Agency, Natural Resources Wales, and Drinking Water Inspectorate have set tighter standards that companies must meet in the 2025–30 period. For example, storm overflow spill reductions and enhanced phosphorus removal at sewage works are legally required, not discretionary. This explains the sharp rise in needed investment.



Affordability & efficiency

Customer bills will rise by roughly 36% by 2030 (about £31/year excluding inflation). To protect affordability, Ofwat cut ~£8bn of proposed costs and trimmed allowed returns (~£2.8bn), pushing companies to deliver more efficiently and innovate.

Performance incentives

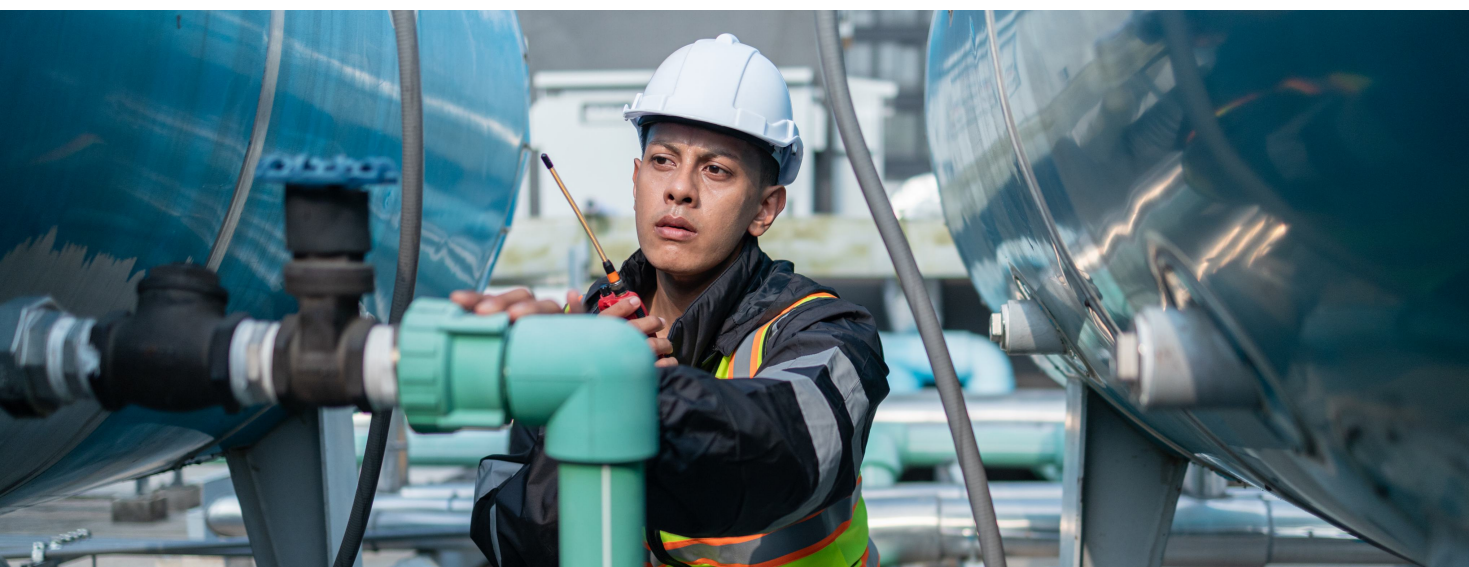
Performance will be tightly incentivised via Outcomes Delivery Incentives (ODIs) on leakage, pollution, service, and more. AMP7 saw significant net penalties (>£430m since 2020) for underperformance, underscoring the need for new, data-driven approaches. Ofwat stresses cultural and operational transformation, not just capital spend.

Digitalisation

Digitalisation is a top strategic priority: embracing data, digital twins, AI, automation, real-time monitoring, and advanced control to unlock efficiency and outcomes. UKWIR's agenda aligns with this, and Ofwat's Innovation Fund will double to £400m in AMP8 to accelerate sector-wide innovation.

Perceptions are split:

47% of sector professionals surveyed by NBS feel construction is "behind the times" digitally, while 26% say it has found its feet³.



04 - How digital engineering is transforming real-world projects

Building Information Modelling (BIM) and 4D/5D modelling

BIM – the digital representation of physical infrastructure – has become a cornerstone for designing and delivering capital projects.

All new water treatment works, pumping stations, and network schemes are now typically developed using 3D BIM models, allowing project teams to collaborate around a single source of truth. This improves design coordination and reduces errors before construction. The benefits multiply when BIM is combined with scheduling (4D) and cost (5D) data, enabling 4D simulations of construction sequencing and integration of cost control.

Case in point: Brighton East WTW (Southern Water)



Challenge:

Fit a new treatment plant into a live operational courtyard hemmed in by offices, a school and a busy A-road.



Digital approach:

4D BIM model built from 2D data, existing surveys and temporary-works plans. During the pre-construction phase, the team conducted 4D rehearsals, visualising the project being built and identifying potential issues.

- The model helped establish fence lines that could remain in place for the entire project duration, saving time and costs.
- Enabled the team to re-route vehicle access, improving efficiency and safety.
- Optimisation of concrete pour sequences before pouring the main slab.
- Minimised disruptions to surrounding areas/public.



Read the case study: [Leveraging 4D Modelling at Southern Water](#)

Broader picture: UK water companies are increasingly mandating BIM Level 2 for new capital projects, and early adopters are expanding to 4D/5D. The payoff is better risk management – catching design clashes, planning logistics, and communicating plans to stakeholders clearly.

Reality capture and digital twins

Another powerful digital engineering toolset involves reality capture (drones, laser scanning, photogrammetry) and the creation of digital twins for existing assets.

Water companies have a vast legacy asset base – many facilities with incomplete or out-of-date drawings. Modern laser scanning can quickly generate a precise 3D point cloud of a plant or underground structure, which can then be used to build an as-is BIM model. This feeds into “digital twin” development: a live digital replica of a physical asset that can be used for simulations, monitoring, and predictive analytics.

Case in point: Inchinnan wastewater pumping station (Scottish Water)

 Challenge: Confined spaces, ageing infrastructure with outdated documentation, and complex logistics for refurbishment works	• 50% reduction in on-site survey time, significantly lowering health and safety risks. • 30% improvement in health and safety compliance through proactive risk identification. • 40% faster stakeholder decision-making due to clear, dynamic visual presentations..
 Digital approach: Laser scanning created a 3-billion-point cloud of confined chambers. The data were converted to a parametric model and linked to the planned refurbishment sequence.	

 Read the case study: [4D Modelling to Enhance On-Site Health and Safety](#)

Broader picture: The UK has a National Digital Twin programme, and water companies like Anglian Water and Thames Water have piloted digital twins for systems like sewer networks and treatment processes.⁴

Data analytics, AI and intelligent networks

Digital engineering also extends to how companies operate and optimise networks day-to-day. Big data analytics and AI are being applied to the deluge of data from sensors, smart meters, satellites, and customer interactions.

For example, several companies have used AI-based models to detect leaks or predict water demand more accurately, which helps reduce water loss and energy waste. UKWIR research has shown the potential of AI to assist in achieving net-zero carbon goals by optimising treatment processes (like aeration control in sewage works) and identifying hidden greenhouse gas emissions.

Case in point: Thames Water’s smart water meter rollout

 Challenge: The Thames Water region is classified as ‘seriously water-stressed’ with a historically poor track record of leakage and waste.	• 13.2% improvement in leakage in 2024/25 against AMP7 baseline⁵ • 146 mega litres of water per day saved since 2015⁶
 Digital approach: Fitting free smart water meters for all customers to improve leak detection, analyse water usage and reduce waste.	• 2 million customers already metered, 1 million more targeted by 2030

 Read the case study: [4D Modelling to Enhance On-Site Health and Safety](#)

Broader picture: Ofwat’s 2024 strategy explicitly cites leveraging data and technology as key to meeting performance commitments, and the innovation fund has backed projects like intelligent sewer monitors and AI-driven water demand management.⁷

05 - Benefit multiplier: the impact of combining technologies

The digital engineering technologies we’ve discussed are not siloed. When integrated and combined effectively, they have the potential to fundamentally enhance how infrastructure is delivered and managed.

 Safety & efficiency • 4D/VR simulations significantly improve site safety and efficiency. • AR/VR is used on most projects for stakeholder engagement and design visualisation. • Virtual walk-throughs let teams spot hazards and optimise logistics before breaking ground, cutting accidents, time, and cost. Impact: A step-change in risk reduction, enabling tighter coordination between designers, supervisors, and contractors.	 Safety & efficiency • Digital twins and predictive analytics enable proactive, just-in-time maintenance. • AI can predict failures (e.g., pump bearings) weeks in advance, minimising disruption. • Monitoring sewers, levels, and weather flags blockages or flooding risks before customers are affected. Impact: A step-change in risk reduction, enabling tighter coordination between designers, supervisors, and contractors.
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 Collaboration & knowledge retention • Digital engineering captures tacit knowledge in models and data, mitigating retirements. • New staff use simulations and decision-support tools to make faster, better decisions. • Shared platforms (e.g., cloud BIM) provide a single source of truth, reducing miscommunication. Impact: Enables higher-quality, faster delivery across designers, operators, contractors, and regulators.	 Collaboration & knowledge retention • Digital tools measure and cut carbon in designs. • BIM-based optioneering reduces materials (e.g., concrete), while advanced controls lower energy use. • Digital twins model climate impacts to guide adaptive planning. Impact: Drives lower embodied and operational carbon, better reporting, and compliance with net-zero commitments.
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06 - Research and industry initiatives

The ongoing digital transformation in water is supported by a web of research and industry collaboration.

UKWIR, as mentioned, has framed “Big Questions” such as “How will we achieve zero leakage in a sustainable way by 2050?” and is driving research pilots⁸. The UK government’s National Infrastructure Strategy and the Centre for Digital Built Britain have championed the Information Management Framework for a National Digital Twin, with water as a key sector.⁹

Ofwat’s innovation competitions have seeded dozens of projects – from AI for leakage to blockchain for water trading. Industry bodies like British Water and The UK Water Partnership have working groups on digital (e.g. promoting standard data formats, cyber-security for operational tech).¹⁰

Finally, Ofwat’s “Time to act, together” strategy underlines that water companies must seize these “untapped opportunities” – being deeply integrated in communities and the natural environment, they have much to gain by innovating. The regulator explicitly states:

By embracing new thinking and innovation, including new technology, water companies can improve performance, benefiting customers, communities and the environment while keeping costs down and securing backing from investors.¹¹

This aligns with everything we have discussed: digital engineering is not innovation for its own sake, but a means to an end – a more resilient, efficient, and customer-centric water system.

07 - Evolving our “hidden assets” for a smarter future

Victorian engineers built extraordinary infrastructure, but they could not foresee today’s demands. The industry now faces a once-in-a-generation injection of capital alongside unprecedented scrutiny.

Traditional methods deliver incremental gains at best; digital engineering delivers multiples:

- safer projects through virtual rehearsal;
- leaner design through clash-free, quantity-optimised models;
- cheaper operation through predictive maintenance and AI process control;
- lower carbon through data-driven material choices;
- improved resilience through live twins and scenario testing.

Early adopters are already proving the case. The challenge – and opportunity – is to mainstream these approaches across all major capital programmes and every high-criticality asset.

Digital engineering is no longer a side project. It is the organising principle that will determine who leads and who lags through AMP8, AMP9 and beyond. By investing now in data quality, skills and repeatable processes, the UK water sector can unlock its hidden assets and deliver reliable, sustainable, affordable services for generations.

This is not to suggest that digital engineering is a silver bullet for all challenges. Building a digital-savvy organisation takes investment in training, change management, and updating legacy systems. Cybersecurity is an ever-present concern as critical infrastructure becomes more connected. And technology must be applied thoughtfully – driven by clear business outcomes. But the direction is set.

The next five years, AMP8, will likely be remembered as the period when digital innovation truly took hold in UK water. Ofwat has effectively challenged companies to innovate or underperform, and no one wants to be in the latter category given the reputational and financial stakes. In this context, digital engineering is not just a technical endeavour – it is a strategic imperative for water companies to deliver on their promises to customers and regulators.

Majenta’s vision is that, with sustained commitment, the “hidden assets” below our feet will become part of a connected, intelligent infrastructure system, one that ensures water – the most vital of services – is delivered safely, sustainably, and affordably for generations to come.

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