AECOM

DRIVING INNOVATION PRODUCTIVITY AND EFFICIENCY

OPTIMISING INVESTMENT IN ASSET HEALTH

IN THE WATER INDUSTRY

Even before coronavirus, water companies were facing an urgent need to change. From sustainability to resilience, profitability, reputation and compliance with regulatory targets, the challenges are pressing. **Andy Gibson**, AECOM's asset management lead explains that to realise the maximum value from their assets, water companies must focus on optimising investment in asset health, enabling work programmes to be targeted more precisely.

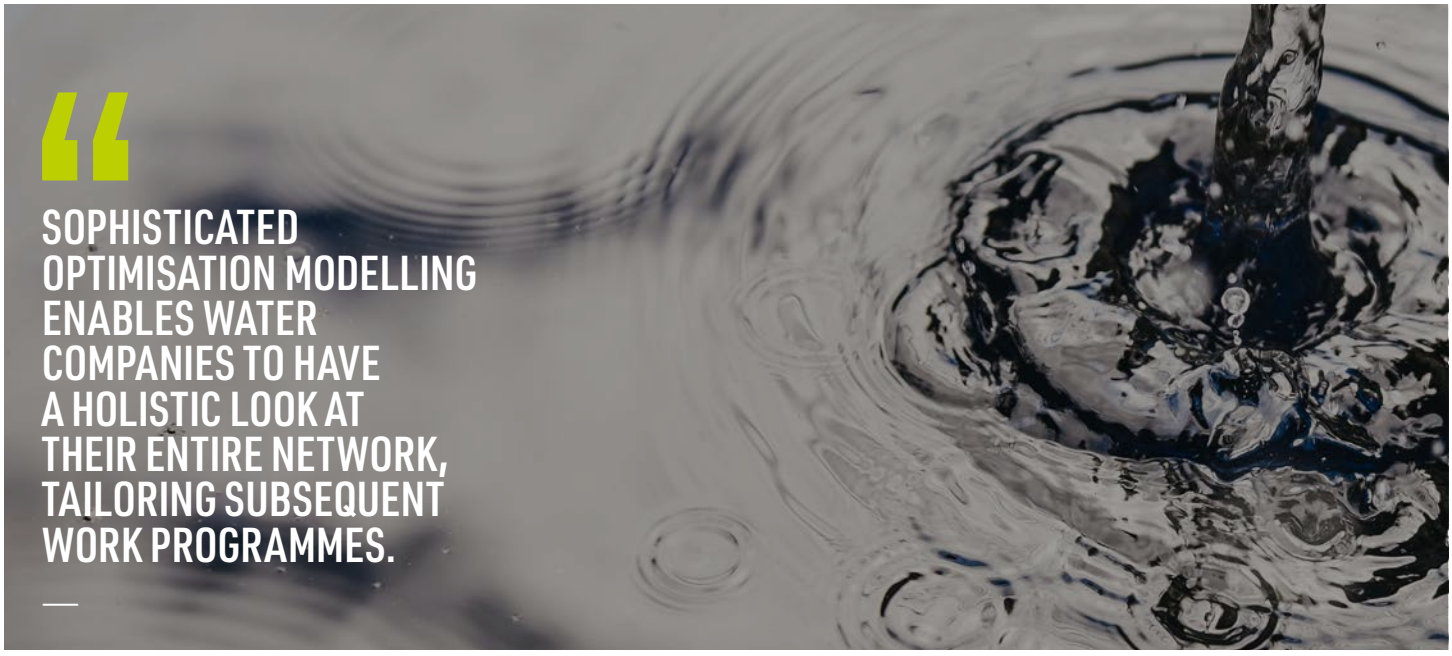
Water infrastructure, including sewers and water mains, have a lifespan. From the moment these assets are installed, they begin to deteriorate due to many different influences. Being able to anticipate where a fix, rehabilitation or replacement is needed makes maintaining assets more effective, optimising investment and focusing resources precisely where they are required. Robust processes for maintaining and managing infrastructure allows organisations to reduce costs, improve performance and minimise disruption to customers from risks such as leaks or flooding. Moreover, it offers peace of mind in turbulent times through the knowledge that assets will continue to operate in the best way possible.

Why is optimisation the answer?

With water regulators across the UK and Ireland setting strict targets for leakage reduction, sewer flooding and drinking water quality during the next regulatory periods, it has become even more important for water companies to avoid penalties and use capital efficiently.

> "THE USE OF OPTIMISATION IS ADVANTAGEOUS WHEN THE PROBLEM YOU'RE TRYING TO SOLVE GROWS TOO BIG OR COMPLEX.

The use of optimisation is advantageous when the problem you're trying to solve grows too big or complex. Working across entire clean water and drainage networks, and using advanced mathematics and complex algorithms, our optimisation tools enable us to predict asset performance over time.



> SOPHISTICATED OPTIMISATION MODELLING ENABLES WATER COMPANIES TO HAVE A HOLISTIC LOOK AT THEIR ENTIRE NETWORK, TAILORING SUBSEQUENT WORK PROGRAMMES.

This means we can deliver optimised, tailored and proactive plans to meet desired performance levels at the lowest cost, preventing the problem before it even materialises.

By compiling water asset data from different locations around the world, we have created customised databases that can be fed into water company-specific optimisation models. This means gaps in datasets can be filled, enabling water companies to take advantage of optimisation techniques now, until such time as they collect local data. In fact, results from an initial optimisation model can help us to understand which data are driving decisions and therefore tailor data collection programmes.

Optimisation is different to prioritisation. Our optimisation tools can compare solutions to different service levels and budget scenarios to inform decision making. For example, it can provide answers to questions such as: 'what is the minimum spend in order to maintain current service levels?' or 'How much can I improve service levels if I spend £X per year over the next 10 years?'

Reducing leakage

There will always be outliers in a pipe network, with pipes leaking or bursting long before they should. However, the advantage of optimisation means that you can identify where this might happen and when.

$4M

Forecast saving for Detroit Water and Sewerage Department per annum over a 20-year period

Sophisticated optimisation modelling enables water companies to have a holistic look at their entire network, tailoring subsequent work programmes. The calculations required are complex, because many factors affect the longevity of the network such as the materials used to make pipes, the soils in which a pipe is laid, and the temperature of the surroundings.

In Detroit, we're working to help reduce the US city's water main burst rate. With a lack of information about pipe materials, AECOM carried out a detailed analysis of the city's construction history, working out when pipes were laid to extrapolate the materials likely to have been used, and therefore the likelihood of leakage, bursts and the most appropriate intervention to prevent them. This data was fed into the optimisation model allowing us to manage risks within the available budget.

We began analysing "pipe coupons", which are the damaged sections of pipe removed during a leak repair. These would have been sent to landfill but are now studied to gain further understanding of the pipe material, level of degradation and internal and external pitting rates. This data further improves the accuracy of the optimisation model. AECOM's work will allow Detroit to target pipe repairs, rehabilitation and replacement, ultimately reducing the city's burst rate.

Preventing sewer flooding

Sewer flooding can be caused by blockages or degraded pipes, but it can also be caused by inflow and infiltration when rainwater and groundwater drain into the sewer system increasing the load on the sewerage network.

Given that sewers have a long lifespan, and it is not cost effective to use closed-circuit television (CCTV) to check sewer condition on significant proportions of sewer assets on a regular basis, the condition of some pipes might not be checked throughout their lifetime. Optimising CCTV surveys to those pipes that are most at risk of failure is essential.

AECOM's optimised sewer rehabilitation model for South West Water in the UK targeted CCTV investigations to those sewers at greatest risk of deterioration. This reduced CCTV investigation requirements by 225 kilometres, saving over £1.35 million.

AECOM's optimised inflow and infiltration models are able to identify where sewer flooding is most likely to occur across a whole network, targeting areas for further inspection, with preventative solutions then outlined and implemented. For example, our optimised inflow and infiltration management model for Detroit Water and Sewerage Department is forecast to save $4 million (£3.2 million) per annum over a 20-year period.

This represents approximately seven per cent of capital investment and will be refined as more data is collected over time.

Improving drinking water quality

Approximately 95 per cent of the UK's drinking water network is phosphate-dosed, which reduces the leaching of lead into drinking water. Legislation to accelerate the removal of lead pipes is expected in the coming years, but uncertainty about their location is a common water company challenge.

Using machine learning and known pipe and water quality samples, predictions can be made across whole water networks to target properties and optimise lead pipe replacement programmes. This enables water companies to identify those most at risk to lead exposure and to identify opportunities for programme efficiency, where multiple pipes can be replaced at one time.

AECOM's optimised lead service pipe identification tool was originally developed for Denver Water and we are currently working with South West Water on a pilot project to develop and test the model in the UK.

Data-driven optimisation

Optimisation is likely to become one of the key approaches the water industry uses as water companies drive to maximise the benefit of each pound invested.

Work to develop and test our global water industry-optimisation models in the UK has already started. Our experience over the past 20 years working with cities such as Detroit and Denver in the US and South West Water in the UK has proven that investment in asset health optimisation can maximise asset value.

The combination of data-driven optimisation modelling, engineering know-how and programme management enables the creation of tailored programmes of work for water companies that proactively deliver both asset health improvements and wider service outcomes. WL

> OUR EXPERIENCE OVER THE PAST 20 YEARS WORKING WITH CITIES SUCH AS DETROIT AND DENVER IN THE US AND SOUTH WEST WATER IN THE UK HAS PROVEN THAT INVESTMENT IN ASSET HEALTH OPTIMISATION CAN MAXIMISE ASSET VALUE