

## Yorkshire Water: Environmental improvements that boost the bottom line

### Executive summary

Most people think that going green is expensive, but Yorkshire Water is helping show that it is possible to save money and the environment at the same time. With help from Trinity Horne, the company carried out a complex analysis of the variables affecting its use of chemicals and power in producing clean water and as a result, identified savings over £2m per year and a smaller carbon footprint.

“At the start of the project, we weren’t sure if there were any efficiencies to be gained from applying Lean and Six Sigma techniques in this area,” says David Owen, Yorkshire Water’s Optimal Planning Manager. “With Trinity Horne’s help we not only quantified opportunity, but we’re well on our way to realising it.”

### Background

Yorkshire Water manages the collection, treatment and distribution of water in Yorkshire, supplying around 1.24 billion litres of drinking water each day and collecting, treating and disposing of about 1 billion litres of waste water safely back into the environment. The company has more than 700 water and sewage treatment works, 120 reservoirs and 40,000 miles of water and sewerage mains - enough to go right the way around the earth. With an aspiration to be the best water company in Britain, it is already among the top-performing utilities, scoring well on the raft of measures Ofwat impose and being widely regarded as a “frontier company” in terms of its efficiency and innovation.

Ten years ago, the story was rather different: one of the poorer-performers, the company was vilified in the press as a “fat-cat” utility. “The secret to the successful turnaround of Yorkshire Water over recent years has been our absolute focus on efficiency and customer service,” says Kevin Whiteman, the Chairman.

### The opportunity: scope for further improvement

The transformation of Yorkshire Water is not over; if anything, past successes have been spurring the company on to identify further improvements and – increasingly – to find ways of reducing its environmental footprint. “We have to deliver our services to the specified quality for the least cost, both in terms of money and environmental impact,” says Yorkshire Water’s David Owen, the project sponsor. “The goal that we’re driving towards is zero pollution.”

Over the last 15 years Trinity Horne has been working with Yorkshire Water to help improve the performance of their people, primarily through the application of Lean and Six Sigma techniques originally developed to improve the processes of manufacturing companies. “Utilities have tended to see themselves as a special case because so much of their cost base was driven by factors, such as the weather, which were beyond their control,” says Trinity Horne’s Jeremy Kinghorn. “But Yorkshire Water realised that processes such as clean water production and waste water treatment were really manufacturing operations.” Yorkshire Water therefore asked the company to look at how the company could reduce the power and chemicals used in its water treatment process.

### How did Trinity Horne help?

Trinity Horne immediately realised that Yorkshire Water’s continuous processes and fixed equipment would benefit more from a statistical analysis of drivers and opportunities – rather than the traditional Lean improvement approach, which focuses on identifying and eliminating non-value-adding process steps. Moreover, simple analysis was unlikely to uncover the complex relationships within these processes and could even have been misleading. “Yorkshire Water has many highly capable and numerate people,” says Kinghorn’s colleague, Donal O’Hehir, “but conventional analysis only gets you so far, and haystack more robust approach was required. There was a huge volume of data about energy and chemical usage, going back over a long period of time, but the problem was how to distil from it some genuine insights into the way water treatment plants worked. We were looking for small changes which, if magnified, could save money and power.”

“We had worked with Trinity Horne before,” says Owen, “but not on this type of project. However, they convinced us that an innovative approach, based on a more rigorous statistical analysis than we could do ourselves, was likely to yield greater benefits.”

Working alongside people from Yorkshire Water, O’Hehir gathered the data into a rich multi-faceted dataset, validated it with Yorkshire Water SMEs, then interrogated it statistically with proven multivariate analyses tools. “The key difference in this type of analysis is that it allows you to view the data from a variety of perspectives,” he explains. “Rather than having to analyse one variable at a time or to look at misleading averages, you can see how hundreds of variables behave together: that’s when you start to really understand what’s happening and how to improve it.”

Chemical usage is controlled at the site level and the dosages of different chemicals are interdependent, so that adding an amount of Chemical A to the water at one stage would affect the amount of Chemical B added at a later stage. “If you can optimise the first dose, you can reduce the second,” explains Kinghorn. It was initially assumed that energy consumption could be optimised in the same way, but this turned out to be more complicated. “We had to look across the entire network,” O’Hehir continues. “Rather than producing 10% of water from Site A, it might, in certain circumstances, be more energy-efficient to take it from Site B.”

Another consulting firm might have stopped work at this stage, having identified potential improvements and delivered its report. But that’s not Trinity Horne’s style. “Ensuring that we leave clients with the ability to take things forward has always been core to our business,” says Kinghorn. That chimed with Yorkshire Water, too, where David Owen wanted to ensure that his team acquired new skills as a result of working alongside the consultants. “Although our immediate interest was in these two, very specific measures, we wanted to ensure that we could do similar work ourselves in the future,” he says.

By contrast, cutting energy consumption will involve doing things differently at Yorkshire Water’s head-office. Trinity Horne’s analysis identified a strong relationship between flow rate of water in a given time period and the amount of power consumed. “The cost can swing by as much as 50% per mega-litre,” says O’Hehir. “Our most significant proposal was for Yorkshire Water to improve its planning in order to take this into account. This will require the development of an algorithm which plugs into their forecasting models and enables them to decide how much water to run from which plant based on the weather and other local conditions.”

## Benefits

The immediate benefits of the project have been savings identified in power consumption. “Depending on various environmental factors, the planning algorithm will save us up to £2 million a year in fuel costs,” says Owen. “On top of that, there is the environmental benefit – which we estimate at 10,000 fewer tonnes of CO<sub>2</sub> released per annum. Donal showed us that you can – with data, knowledge and ingenuity – find genuine savings in operations such as these. We started with just a hypothesis: Trinity Horne helped us prove it.”

Savings in chemical usage depend on behavioural change, something that is less easy to predict. “But,” says Owen, “having worked on two pilot sites we have an idea of how much can be saved so we know it’s worth doing something about. We now have a business case for change.” “The conclusions here weren’t particularly surprising,” agrees O’Hehir. “The use of chemicals is largely driven by local weather conditions. What was helpful was that we were able to quantify the degree to which that matters and to separate it from other factors, primarily people’s behaviour.”

Just as important as the identified savings, Trinity Horne’s work has left Yorkshire Water with a pool of reliable and accurate data which the company will be able to analyse in the future. “This is a data-rich environment,” says O’Hehir, “and there is a huge opportunity to exploit this in order to identify further improvements in the future.” Owen agrees: “One of our objectives was to create the internal resources and capability to use a similar approach in the future. It’s been a great experience for all those involved.”

## Challenges and critical success factors

Three challenges stand out in this project:

- **Finding improvements required an innovative approach:** Yorkshire Water has accrued a wealth of skill in identifying productivity improvements, so finding new savings was always going to be challenging and dependent on taking a different approach. “Lean is not a particularly quantitative method,” explains O’Hehir, “Six Sigma is more so, but the analysis we carried out was way beyond what you would expect in a project of this nature.” “We were only able to identify these savings because Donal took the best of Lean and Six Sigma and customised them for our needs,” Owen adds. “A conventional approach might have yielded some savings, but not on this scale.”
- **Engagement:** The drawback to doing things differently is that people can be suspicious. Yorkshire Water’s engineers and operational staff were initially sceptical of an approach that relied on data modelling; they also had strong views on what they thought the drivers of usage would be. “In such situations it is critical to ensure you win the support of these experts,” says O’Hehir, “because you are dependent on their input.” This meant a careful balance between encouraging people to come up with their “wish-list” while also challenging some long-cherished assumptions. “Giving everyone a chance to contribute goes a long way,” continues O’Hehir. “We build that into everything we did.”
- **Credibility:** Crucial, not only to engaging people in the first instance, but also ensuring that any recommendations would be acted on, was the credibility of the analysis. Huge efforts on both sides went into gathering and checking the data used so it would stand up to the most robust challenges. “But what was really different about this project was the extent to which Trinity Horne tailored their approach to our needs,” says Owen. “The fact that they knew what they were talking about meant they had an instant rapport with our team.”

## The client-consultant relationship

The first thing that strikes you, listening to the people involved in the project, is synergy. Trinity Horne was bringing a practical understanding of the application of advanced statistical analysis, something that can be applied in any organisation. What Yorkshire Water brought was a profound knowledge of its own business – and it was the combination of these two skills that made the project such a success.

Yorkshire Water set up a core team of people to work side by side with Trinity Horne who were familiar with the data and understood the clean water treatment processes. “We worked directly with them from day one,” says O’Hehir, “and got on very well with them. We know that getting the data for this type of exercise is never easy and sometimes we had to have difficult discussions where someone had spent a lot of time pulling together data which, through no fault of their own, had problems with it. It’s the kind of thing that could have been frustrating and demotivating, so it was a testimony to the strengths of the relationship that had been forged that we were treated as colleagues, not resented as outsiders.”

“We didn’t know what the results were going to be when we started this,” admits Owen. “Even half way through the project, we were still very sceptical: nothing seemed to be jumping out at us. The whole initiative felt like a leap of faith to us. It wasn’t until Donal had completed and taken us through his meticulous analysis that we could really see the potential. Trinity Horne had never doubted their approach for a second – and they were proved right.”

**David J Owen, Optimal Planning Manager, Yorkshire Water**