Burrows WTW -Nitrate Blending Scheme

a case of 'environmental Sudoku'

by
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Burrows WTW is one of South West Water's smaller water treatment works, located near the town of Dawlish in South East Devon. Whilst it is a small works, it is geographically important as it supplies drinking water to an area where population significantly increases during the Spring and Summer seasons due to tourists holidaying in this beautiful part of the county. The works, positioned on top of a hill, has magnificent views of the surrounding countryside. Access is via small country lanes with high Devon hedges on either side of the road and deliveries have to be made in small vehicles. The treatment works receives ground water from two boreholes called Duck Aller and Venn Bridge, which are physically located approximately 4km to the North. The boreholes are relatively shallow and in an agricultural valley; each is licensed for a monthly yield of 4 Ml/d. Farming practices of using nitrate based fertilisers has resulted in elevated nitrate in the ground water, levels have steadily increased during the last ten years and it is predicted to rise further over the next 15 years. The permitted concentrate value (PCV) for nitrate in the treated water quality of 50mg/l could not be guaranteed by encouraging landowners to avoid the use of nitrate based fertilisers, hence the need for a capital scheme to reduce the nitrate level to achieve a consistent level below the PCV.

Burrows WTW scheme under construction

photo; courtesy South West Water

Scheme

A nitrate removal scheme, using ion exchange units supported by the Drinking Water Inspectorate (DWI) was approved and put into the K4 Early Start Scheme. During the planning stage, concern was expressed about the associated operational expenditure (OPEX) requirements and associated brine waste created as a result of reducing the nitrate content in the water.

Re-evaluation

A detailed re-evaluation of the scheme was conducted, which consequently highlighted a number of options, each with its own engineering challenges and impact on the environment, hence the term environmental 'Sudoku' was coined. The blending scheme, in principle, was straightforward; achieving it using a consistently low nitrate blending water via a gravity main, was another issue. Each proposition had its own complex problem to solve. Financial, environmental and time constraints certainly focused the mind. The DWI were approached and they **agreed to support a blending scheme** which had the same capital cost as the nitrate removal scheme at a significantly reduced OPEX cost.

Benefits of the blending scheme included:

* less energy intensive;
* reduction of CO2 emissions;
* reduced operator intervention;
* increased asset life of plant;
* avoidance of requiring 5m high building on a site which could be seen for miles, due to its elevated position on a hillside;
* avoided possible nuisance to neighbours caused by large delivery vehicles bringing salt into the works for the ion exchanges;
* greater flexibility of distribution system;
* allows boreholes to be rested in winter to conserve supplies;
* facilitated reduced manning of the treatment works.

Blending scheme
The blending scheme was made possible by the construction of a 5km gravity water main and connecting it into the network. A second water main that was programmed to be replaced was brought forward in the Capital programme and increased in size to accommodate the required flows.

This approach also reinforced the benefits of adopting an asset management methodology approach. In constructing the pipeline it was necessary to cross several environmentally sensitive areas and a river crossing however, *it would improve the sustainability of the resource.*

MJ Gleeson, one of South West Water's construction partners for the K4 period, selected *AE Yates* to undertake the directional drilling. A *Wirth ADDS Powerbore,* commonly called a horizontal directional drilling (HDD) was utilised to cross the river and environmentally sensitive areas. The (HDD) has a minimal impact on the surrounding countryside, and installation lengths of up to 6500' were possible. The benefits of this technology meant reduced traffic disruption, lower construction cost, deeper installation possible, longer installation lengths possible, shorter completion time, no access pit requirement and safer for the environment.

The HDD pushes a "bore head" which is connected to a hollow pipe into the ground at an angle. As each joint of drill is pushed into the ground a new one is added behind. The location of the bore head is called a "walk over" locating system. A transmitter behind the bore registers the angle, rotation, direction and temperature data. The information is then encoded into an electro magnetic signal, which is transmitted to the surface. The HDD and steering directions are relayed to the specialist controlling the bore machine, who can make the necessary changes in direction as required.

Purac Ltd., South West Water's process partner provided the necessary expertise in blending and modifying the chemical mixing inside one of the on-site reservoir compartments. A further environmental consideration was to safeguard potentially rare orchids growing in the grounds of the water treatment works. Dawlish Warren is nationally recognised by horticulturists as being an area where rare orchids grow as well as the unique Warren Crocus (Romulea columnae) - only found at this location. The crocus is protected under the Wildlife & Countryside Act 1981 - Schedule 8. It was, therefore, necessary to undertake an environmental assessment of the works grounds, as well as the route of the new pipeline. Part of the project plan specified daily monitoring of the area where orchids were known to grow, photographing the specie as they formed their flowers and marking the exact location with an identifier. This was undertaken by a member of the SWW operational team who is a keen botanist.

The photographs were then studied by an orchid specialist who advised the construction team how to move them to another area with the same habitat during their dormant cycle.

Final stage
The final stage was to install a radio Ethernet and control system between the boreholes, water treatment works and parent hub site that is permanently manned. This allowed operators on the remote site to vary the abstraction rates, reducing daily visits to the sites to occasional visits, *which formed part of the water treatments strategy of increasing their performance rating in the OFWAT benchmark.*

This project highlighted the benefits of adopting a partnering approach to construction and utilising the internal strengths of the client. The delivery of the scheme was difficult due to the need of maintaining the resource available, maintaining our environmental obligations, delivering a scheme to a defined delivery date and providing a commercially viable output.

The team
The team involved in delivering the scheme included, MJ Gleeson, construction partner; Purac, process contractor; Faber Maunsell, design partner; South West Water operations department, which provided specialist services from its Water Treatment and Scientific Services sections; planned with the co-ordination and project management undertaken, by the Companies Asset Management & Development Department. ■

Note: *The author of this article, Paul Mitchell, of South West Water's Asset Management and Development Department, is the Company's Project Manager for the Burrows WTW scheme and the K4 Early Start Water Treatment schemes*