A case study

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Bamford Water Treatment Works

major asset renewal & quality improvements at key WTW

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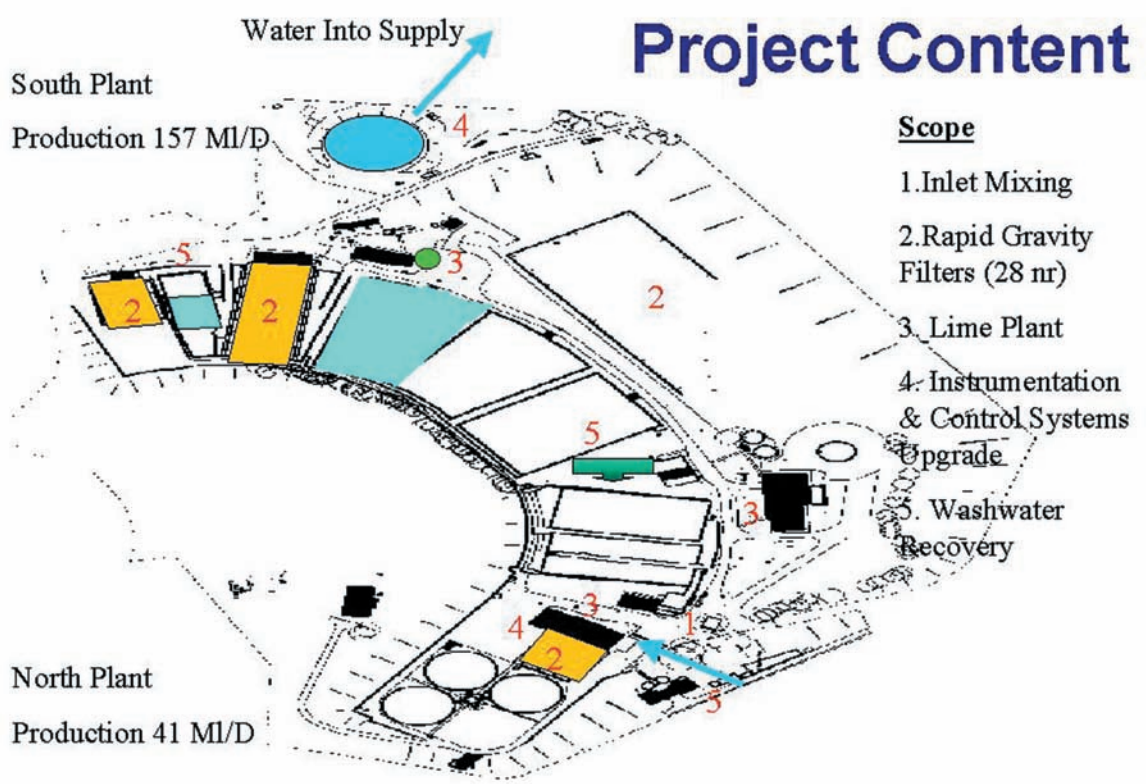
Bamford Water Treatment Works, situated west of the city of Sheffield, lies within the Peak District National Park an area of outstanding natural beauty and one of the most visited parks in Europe. In order to protect this important habitat, development is subject to approval by the Peak Park Planning Authority and it was essential that work undertaken by Severn Trent at this site was carefully considered with a view to minimising environmental impact.



The treatment works abstracts water from three reservoirs in the Derwent Valley and also from local rivers and its ability to reliably supply the East Midlands with relatively inexpensive water identified the site as one of Severn Trent Water's key strategic resources.

Bamford's average output of 160 MLD (megalitres per day) provides water to a population in excess of one million either as a single or blended supply. It was essential that any future development would not compromise its position and hence the constraint on any engineering work was the requirement to maintain a supply of at least 135 MLD.

Since the original WTW was constructed on the site there have been numerous improvements and changes to the treatment process. It was upgraded in the early 1940's with horizontal flow sedimentation followed by filtration through 16 rapid gravity filters (RGF)[1]. In 1969, capacity was increased with the construction of a new treatment works at the north end of the site, which consisted of three upward flow clarifiers and 6 RGFs. The original works, which now became known as the South Plant, underwent a major refurbishment in 1986 with the existing horizontal flocculators being converted into flat bottomed upward flow clarifiers. At this time additional RGF capacity was introduced bringing the maximum output of the site up to 198 MLD (157MLD from the original south plant and 41MLD from the north plant.

Current process

The current process involves coagulation with iron salts followed by upward flow clarification. The clarified water is then chlorinated and pH increased to remove manganese prior to filtration. Post filtration water is dosed with orthophosphoric acid to reduce the tendency of the soft upland water to be plumbosolvent. The chlorine residual and pH are adjusted prior to leaving the site via the Derwent Valley Aqueduct (DVA). There were several restrictions within these processes that needed to be addressed.

In March 2001 a project was promoted primarily to address asset renewal issues but at the same time to provide some quality improvements. A scope of works comprising of five target areas was developed.

* Inlet works mixing – enhancement of the existing inlet arrangements to improve chemical mixing and blending/control

of returned process supernatant liquors. This involved the installation of a chemical induction mixer *(Chlorovac)* to improve the mixing of primary coagulant at the inlet works and direct injection of hydrated lime slurry. A post installation survey of the pH profile demonstrated that a homogenouus mix had been achieved with immediate benefits to the effectiveness of the clarification process.

* RGF Refurbishment – representing 50% of the contract, this involved refurbishment of all 28 rapid gravity filters. In order to comply with minimum water treatment output requirements and to minimise operational risk, this work necessitated careful programming in batches of 3-6 filters at any one time. The RGF work dictated the critical path of the contract.

* Lime dosing – replacement of the hydrated lime and Kalic (milk of lime) bulk storage/conveyance/make-up and dosing systems that are required for pH control.

* Washwater recovery – provision of a recovery/treatment facility for the dirty washwater arising after filter cleaning in order to maximise its recycling potential. This was an essential area to reduce the variability of water returning to the works inlet allowing a consistent pH regime to be maintained. A *Vexamus* package lamella plant was selected for this purpose on account of the small footprint and limited visual impact of the equipment.

* Instrumentation – provision of a suite of monitors to be used for process optimisation, to determine any changes in raw water quality and as part of additional monitoring of the licensed discharges from the site. The suite of analysers was required to capture data pertaining to turbidity, iron, colour, chlorine and pH parameters.

In December 2001, *Norwest Holst Construction Ltd* entered into a target price/cost reimbursement contract with Severn Trent Water Ltd using amended G90 conditions and valued at £5 million. Norwest were selected for their innovative designs as well as for their proven track record and environmental awareness from previous work refurbishing the viaducts which span nearby Ladybower Reservoir. **Norwest** rapidly mobilised their project team comprising *Pick Everard* as Principal Designers and *Boulting Group* as Electrical Designers.

By April 2002, initial designs had been completed, the site was mobilised and the first batch of three filters was taken out of service for refurbishment. Weekly operational liaison meetings became an essential tool in the delivery of the contract by ensuring the co-operation of construction site and operational site activities. This liaison included the handover of plant, scheduling of site deliveries, permit issues, site security and to agree to any additional measures required to manage any quality, environmental or health and safety risks.

By October 2002, the project was on programme and preparations were being made to commence the refurbishment of the last bank of filters (South Plant 1-16). Alternative solutions were being investigated to establish whether they could deliver any reduction in the overall construction programme and to reduce overall cost.

Also in October 2002, the Drinking Water Inspectorate approved a new composite filter floor system (the LP block) developed and supplied by Severn Trent Services. It was claimed that the LP block system could be installed a lot quicker and easier than conventional filter floors. Due to its unique configuration, filter washing regimes could adopt combined air/water washes leading to revenue savings and the inclusion of the media retention plate would reduce overall filter bed depth and negate the need for any support gravels.

To date, the project is able to report some notable successes. The project is ahead of programme with the inlet works improvements being complete, as are the chemical dosing and instrumentation installations. The fixed plate lamella washwater recovery plant is delivering exceptional results in phase separation. *Norwest Holst* advised Severn Trent of the potential benefits of LP block, and the expectations in its performance and ease of installation have been exceeded. The original planned completion date of August 2003 is forecast to be beaten by eight weeks, which is largely due to the change in filter floor design. The minimum output requirement of 135ML/D has been achieved, operational security has been maintained at all times and there have been no quality, environmental or health and safety incidents. ■

References

1. RWS Thompson, Paper Number 5642 "The Reconstruction of Bamford Filters Min.Proc.Instn Civ. Engrs, 1947 -8 page 205.

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