

# Worksop STW, Nottinghamshire phosphorus removal & tertiary treatment plant

by

Kevin Gaunt BEng (Hons), CEng, MIMechE & Atul Patel BSc (Hons), CEng, MIEE, MCIWEM

**S**evern Trent Water's Worksop STW is a conventional filter works located to the east of Worksop, north Nottinghamshire serving a population of 65,000 and also treating significant and varying levels of trade effluent. During AMP3 the works consent has been tightened to include a 3mg/l ammonia limit and a requirement to reduce phosphorus levels.



Worksop STW: Outlet from the NSAF

courtesy: Severn Trent Water

## Project details

To achieve the new ammonia consent the project included the provision of a Nitrifying Submerged Aerated Filter (NSAF) and a Tertiary Treatment Sand Filter. A new NSAF feed pumping station was also required to deliver effluent to the new process units. In addition, the existing bacteria fed filters were fitted with netting to eliminate fly nuisance. Chemical dosing with ferric sulphate was the selected process for phosphorus removal. The works to be constructed comprised a dosing plant and two dosing points, one of which incorporated mechanical mixing and a contact tank.

The project team selected to deliver the project comprised multi-disciplined staff from STW as the client and *Volker Stevin* as the contractor. STW's engineers took the lead design role taking specific responsibility for the initial civil design work. *Volker Stevin* then took responsibility for the detail design, both civil and M & E. At the project manager level an overview team was set up to ensure that any problems were jointly owned and solved using whatever resources were available within the team.

## Design issues

The phosphorus removal plant design was developed between Severn Trent Water and *Tyco*. The previous standard design comprising an integrated storage tank, bund and kiosk arrangement has been replaced by a new arrangement comprising a separate storage tank, tanker filling arrangement and concrete bund, small kiosk which houses the dosing pumps and control equipment and tanker standing area. The tanker standing area incorporates a spillage containment area. Design is based on tried and tested designs, therefore eliminating the need to carry out finite element analyses for bespoke designs. To ensure a more effective and efficient use of the chemical a diurnal profile was developed. The necessary contact time to ensure flocculation was provided by using large concrete pipes incorporating turning chambers. These were chosen for economy and were hydraulically engineered for minimal head loss.

The NSAF and the DBF each comprise four large concrete cells. A significant feature of the design was that the clear and dirty water



Workshop STW: Manual screen on inlet to protect proprietary T blocks

courtesy: Severn Trent Water

wells were integrated with the NSAF and DBF to reduce the number of structures and minimise construction costs. The inlet to the NSAF was provided with a bar screen to protect the plant and minimise routine operational and maintenance input. The backwash pumps were installed at ground level outside the clear well to eliminate the need for an elevated lifting facility and ensure easy access for operating and maintaining the pumps. Access and egress was provided at each end of the structure to ensure safe alternative routes. Control of all the plant was combined to include all pumping, actuated process valves and blowers in one motor control centre for ease of operation.

#### Collaborative working

It was recognised that successful project delivery within the required time scale was dependant on a number of key factors; notably the performance of the M & E plant (and its suppliers) and the quality of liaison with site operators. To manage these enablers the Overview Team, in conjunction with BTPO (Building the Passionate Organisation) sought to develop a strategy that would involve and bring together the key stake holders. The cornerstones of that strategy were to look for ways of doing things differently, to promote a 'thinking environment', to learn about 'collaborative working' and to promote a culture of common purpose and understanding through focussed discussions.

A plan was developed that included a 'team day' and various activities such as joint team problem solving that were intended to develop "a team that could not help but deliver excellence" Other specific areas targeted for special attention included Health & Safety and the achievement of zero defects following commissioning.

#### Supply chain

A key output of the collaborative working approach was development of relationships between *Volker Stevin* and key suppliers. Severn Trent Water already had in place a Framework Agreement with *Tyco Control Systems* for the chemical dosing plant and with *CEMA* for MCCs. Another key supplier was *Severn Trent Services* who designed supplied and installed the NSAF and Tertiary Filter Plant. They were contacted at an early stage in the project and worked closely with the project team to develop design and delivery requirements.

#### Health & Safety

As part of their efforts to ensure the Health & Safety of all those involved in the project *Volker Stevin* used their 'working well together' approach. This approach was based on the involvement of various construction operatives who acted as a focal point for the raising of health and safety concerns and also carried out site checks themselves. In addition the contractor's Project Manager also carried out a review of both the contractor and client's health and safety management system with a view to eliminating duplication of effort and improving communication of health and safety issues.

#### Programme

Construction commenced in April 2003 and was completed on time, within the agreed target price. The new processes were commissioned in December 2003 and have continued to operate reliably and efficiently. It was recognised that the process units are typical of those to be provided at other Severn Trent sites, so a review was arranged with the Operational Site Manager, to identify where further enhancement could be made. These enhancements will be fed into designs for subsequent projects. ■