

# Balby WwTW, S. Yorkshire

## delivering RQO compliance to a challenging programme

by  
Chris Bingham DIPWEM & Gary Stephenson BSc.

**B**alby WwTW, located on the edge of Doncaster, South Yorkshire, serves a population equivalent of some 16,000: the proposed AMP3 RQO (River Quality Objective) consent is 20: 10: 5. Significant investment was required to satisfy this new standard which needed to be completed in less than a year to meet a compliance date of 31/03/04. This very tight time scale to meet the Regulatory Compliance date meant that close team working, innovation and focus was required to deliver this project on time, whilst achieving cost and quality objectives.



Balby WwTW

Photo: ETM; courtesy: Yorkshire Water

### **Inlet works**

The works discharges to the 'Mother Drain' which flows to the River Torn (fishery), in addition the 'Mother Drain' is used as augmentation water for a nearby nature reserve, designated a SSSI. The water treatment works, therefore, is an environmentally sensitive site, as a result of these sensitivities the formula A consent is set some three times the value that would be expected if conventional calculations were applied. The inlet works, however, was not wholly designed to deal with these flows.

### **Biological treatment**

Treatment had been achieved by an ASP and tertiary mineral media percolating biological filters, followed by humus settlement. Due to a) the age and condition of the filter assets and b) the wholly inadequate design of the single humus tank, the continued operation of the existing tertiary treatment plant was not sustainable.

### **Sludge handling**

Sludge handling consisted of a picket fence thickener for primary sludge and a single drum thickener for surplus activated sludge, before storage and subsequent export from the site. The single drum thickener was undersized and was therefore required to run for excessive periods. In addition, there was no buffer tank prior to thickening. Any down time, therefore, quickly led to build ups of

SAS in the ASP which could not be accommodated in the settlement tanks.

### **Electrical assets**

A major concern was the 'Control Building MCC' which was built in 1969 and contained components that were no longer available. Repairs therefore were completed using parts from other MCCs. The availability was limited and major parts of the process plant would be lost on asset failure.

### **Contract/Contractor**

The contract employed is a modified NEC ECC type (based upon a target cost with a pain/gain share mechanism) used by Yorkshire Water to deliver the majority of its AMP3 programme. This innovative arrangement employs Capital Solutions Partners (CaSP) assigned to specific geographical areas. The CaSP covering the south of Yorkshire Water's waste water operating area (predominantly South Yorkshire and part of NE Derbyshire) is a partnership of *Earth Tech Engineering* and *Morrison Construction* operating as ETM.

### **Brief and design**

The brief was issued to ETM on 3rd July 2003 with a target cost of £2.4m. Early VM studies identified efficiencies in excess of



Balby WwTW: To meet compliance

Photo: ETM

£0.25m. From there ETM developed a 'Basis of Design' document to ensure all parties had a common understanding of the proposed detailed solution. Design time was able to be minimised by, wherever possible, reusing and improving on designs from previous projects. In addition it was necessary to order the major plant items immediately. The speed of design and procurement was possible because team members were fully focussed on delivering the project to challenging timescales but with full control of costs.

### The project - inlet pumps

Provision of a single submersible inlet pump to act as standby to existing screw pump units,

### Inlet screen

Provision of a new 550 l/s screen in the existing bypass channel. The two existing screens were retained and operate as assist/standby. This arrangement provides screening for Formula A flow of 947 l/s. The screens achieve solids separation to 6mm in two directions and are arranged for automatic changeover between the duty/assist and standby screens together with automatic closure of penstocks to the assist/standby screen.

### Screenings handling

Removed screenings are washed and dewatered in duty/standby *Starwash* units to ensure they are clean of organic and faecal matter and sufficiently dry to contain no free draining liquids..

### Final effluent tanks

The final tanks were taken out of service in sympathy with the on-going operations and fitted with replacement scraper blades, scum board and scum removal system.

### SAS belt thickener

An additional SAS belt thickener in a new portal frame building has been installed. The new thickener works as duty/standby with the existing drum thickener. On failure of belt during the sludge thickening cycle, the existing drum thickener starts automatically, or vice versa. A dry powder polymer flocculation system was used for the new belt thickener. The unit has its own vacuum loading system utilising polymer from 25kg bags.

### Sludge liquors & bund drainage

Liquors from the new thickening plant (including floor and bund drains) discharge by gravity to a new Sludge and Tertiary treatment return liquors pumping station.

### Return liquors

Return liquors from the new belt thickener building, tertiary treatment plant and existing sludge tanker drain will be drained by gravity to a new 'Sludge and Tertiary Treatment Return Liquors Pumping Station' and returned downstream of the FFT flume for treatment in the works.

### Existing sludge drum thickeners

The existing drum thickener was refurbished and fitted with a powder polymer system.

### Sludge export tank

An external tank mixer was fitted in order to reduce settlement problems in the existing Sludge Export Tank.

### Tertiary treatment

The existing tertiary treatment plant was replaced by five Continuous Upflow Sand Filter units. These units operate continuously. Water filtration and sand washing are uninterrupted, Two compressors (duty/standby) supply air to an air lift pump. Function of the air lift pump is to lift the sand, which contains the entrapped solids, from the base to the sand washer at the top of the unit. The sand filter silos are a stainless steel structure.

### Final effluent pumping station

A replacement final effluent pumping station was provided to supply the site washwater. This pumping station installation operates on the fixed speed *Auto- Pneumatic system* and incorporates two submersible pumps (duty/standby), control instruments and a diaphragm vessel containing water and gas at the required pressure.

### Final effluent booster pumping station

A final effluent booster pumping station provides a supply of 6-8 bar pressure for the washwater to the new belt thickener, necessary for belt washing.

### Electrical

The additional electrical load required could not be accommodated by the existing infrastructure, hence the electricity supplier was required to up-rate the incoming supply sub-station. The 'Control Building MCC was replaced on-line, but again in sympathy with ongoing works operations.

### Site works

The project achieved ETM "5 Star Status", this prestigious award is granted to sites that show a high regard for safety and project management and financial control.

The project achieved takeover on 24/3/04 and is forecast to outturn at £2.19m. It has been nominated by Yorkshire Water for two internal excellence awards.

**This again is testimony that each and every team member had the same goal of delivering the project within very challenging time scales – but not at any cost. ■**

**Note on the authors:** *Chris Bingham is an Electrical Engineer with Earth Tech Engineering Ltd & Design Team Leader for ETM; Gary Stephenson is a solutions Manager for Yorkshire Water.*