

# Derby STW Reconstruction

## new works for old to serve PE of 500,000

by  
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**D**erby STW, located on the southern edge of the city of Derby, was originally constructed at the beginning of the last Century. Substantial improvements were made to the works in the 1950s and again in the early 1970s. The old works utilised trickling biological filters-and although the site is large it is surrounded on three sides by residential property and over the years there have been an increasing number of complaints of flies and odours. In 1997, with many of the assets nearing the end of their useful life, much tougher effluent standards on the horizon and the continuing environmental issues of odours and flies, Severn Trent Water Ltd decided to reconstruct a large portion of the works.



Aerial with site borders etc reimposed (courtesy Severn Trent Water)

Design of the new works was entrusted to Severn Trent's in-house engineering department and a dedicated team was set up to design and manage the project.

### Existing consent for the old works is:

- 25 mg/l BOD;
- 35 mg/l SS;
- 5:10 mg/l NH<sub>3</sub> (Summer/Winter)

### New consent to come into force in December 2003 is:

- 20mg/l BOD:
- 30mg/l SS:
- 3:5 mg/l NH<sub>3</sub> (Summer:Winter)

In 1997, it was not known if the works would be subject to a phosphorus consent although it was thought likely. A phosphorus consent of 1 mg/l was subsequently confirmed during reconstruction.

**The works is required to cater for a population of 240,000 plus large industrial flows giving a total population equivalent of 500,000.**

It was thought that the nature of flows entering the works would make a biological nutrient removal Activated Sludge plant a viable proposition at Derby and Severn Trent's Technology and Development Department set up a pilot plant on the works to refine the ASP process design.

Following the development of preliminary design and layout a



Aerial shot (courtesy Severn Trent Water)

comprehensive site investigation was initiated towards the end of 1997. Land to the south of the existing works, required for the reconstruction, was occupied by large sludge lagoons and a tip, used over many years for sludge storage/waste disposal. It was known that in earlier years of less stringent trade effluent control, sludges at Derby were contaminated by a variety of heavy metals, so as well as obtaining information for structural design a very important element of the site investigation was determining the degree of contamination. The site investigation contract was carried out by *Geotechnics Ltd* under the direction of *Charles Haswell and Partners* at a cost of £320,000. The investigation included 92 boreholes, 7 test pumping boreholes and 124 trial pits.

A planning application supported by a full environmental impact assessment was submitted in early August 1998 with permission being granted in late September.

In the Spring of 1999 *VHE Ltd* commenced work on a £2.25m advanced earthworks contract. This involved the construction of a cut off wall across one of the sludge lagoons and the removal of some 100,000 tonnes of sludge and fill material to licensed tips thereby rendering the site 'clean' in preparation for the main construction activities.

### Three phases

Reconstruction of the works was planned to be carried out in three phases. **Phase 1** was the largest phase and included 80% of the new ASP and new sludge treatment facilities. Completion of Phase 1 would allow up to 75% i.e 3 blocks, of the biological filters to be taken out of service thus releasing land for the remaining 20% of the ASP (**Phase 2**) and the new Primary Sedimentation Tanks and Storm Tanks (**Phase 3**).

Detailed design continued through 1998/99 and the contract for **Phase 1** work was awarded to *Birse Construction Ltd* in July 1999 with construction commencing under AMP2 in September 1999. Main elements of the contract were:

- \* 8 lane x 3 pass activated sludge basin - each lane approx 6000m<sup>3</sup> volume
- \* 12 x 28m dia. final settlement tanks;
- \* ASP blower house with capacity for Phases 1 & 2 ASPs;
- \* sludge treatment building housing 3 primary sludge thickening centrifuges and 5 surplus activated sludge belt thickeners;
- \* a 3000m<sup>3</sup> capacity sludge digestion plant;
- \* control centre & workshops;
- \* vehicular access bridge.

In early 2000 it was confirmed that the works **would** be subject to phosphorus consent from December 2003. Design of the ASP had allowed for its future conversion to a nutrient removal plant and to affect the change the contract was re-negotiated to a **Target Price Contract of £30.5m**. This method of procurement, incentivising all parties to seek savings, also aligns it with the company's procurement strategy for AMP3. This contract was commissioned in December 2001.

**Phase 2** comprising the remaining 20% of the Activated Sludge basin plus 3 further 28m diameter final settlement tanks and various ancillary works, was negotiated with *Birse Construction Ltd* at a **target price of £7.9m** with completion due in May 2003. Benefiting from the experience gained from Phase 1, this contract was successfully completed and commissioned in February 2003

**Phase 3** was awarded to *North Midland Construction Ltd* at a **target price of £6.8m** and construction commenced in February 2002. The main elements of the contract are::

- \* 6 x 28m dia. Primary Settlement Tanks;
- \* 5 x 34m dia. Storm Tanks;
- \* Sludge Pumping Station;
- \* new storm water effluent water outfall;
- \* various ancillary works;
- \* completion of this contract is due in June 2003.

Commissioning of **Phase 3** will see completion of the reconstruction of the main process units of the works. Remaining works to complete the project are a new digested sludge dewatering plant which is programmed for construction during 2003 to be followed by demolition of the redundant units of the old works and final landscaping.

**Pumping station**

All flows arriving at Derby STW require lifting into the works via a **Main Transfer Pumping Station**. This pumping station constructed in the 1950s suffered an unexpected catastrophic pipe failure in late 2000. An emergency repair was carried out and various options considered for securing the reliability of the pumping station. Safety considerations and the paramount requirement of reliability led to the decision to build a new pumping station.

Several conceptual options were considered by Severn Trent before inviting contractors to submit bids for the work. The contract for development of a design and construction of the new station was awarded to *Barhale Construction plc* in August 2001 at a **target price of £4.95m**. This pumping station with a capacity of 6m<sup>3</sup>/sec provided by 14 pumps was required to a very tight timetable. Severn Trent had developed a strong working relationship with the Environment Agency, the Planning Authority and local residents thus facilitating a fast track approach.

**The proposed pumping station was the subject of intensive model testing enabling the detailed design to be refined as construction progressed. From blank paper this 6m<sup>3</sup>/sec 1300kW pumping station was delivered in approximately 12 months with commissioning taking place in Summer 2002.**

A feature of all of the contracts at Derby had been the strong team approach that developed to meet exacting demands. Central to this has been the target price approach of procurement with all parties focused on common goal. ■

*Note: The author of this article, R Woolley, is Project Leader, Severn Trent Water - Derby STW Reconstruction.*



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