Monkmoor STW - New Activated Sludge Plant

£11.7m scheme upgrades performance of STW for Shrewsbury

by
Richard Thomson BEng (Hons)

The existing works at Monkmoor STW comprises a conventional biological filtration treatment process, storm storage facilities and a sludge digestion facility, serving a population of 81,576, with a full flow to treatment of 55,512 M³/d and has a consent of BOD 25mg/l, SS 45 mg/l, Ammonia 10 mg/l. The site also accepts imported sludge which is delivered by road tanker. The proposed scheme will replace the biological treatment process with an activated sludge plant, provide a new sludge thickening system, provide storm tank auto washing facility and re-inforce the incoming power supply. The scheme includes asset renewal to sections of the existing works to increase reliability of the plant. Following successful commissioning of the new plant the 12 existing biological filters and associated humus tanks will be demolished and landscaped, thus eliminating the risk of fly nuisance to the local residents. The project will enable the works to meet ammonia consent and to maintain the plant as a licensed waste treatment plant.

Monkmoor STW: Spaans screwpump installation *Photo: courtesy Biwater Treatment Ltd*

Contract conditions & cost

The contract for implementing the project was awarded to *Biwater Treatment Ltd* on a cost reimbursable basis at an agreed Target Cost of approximately £11.7 million on 14th February 2005.

The scope encompasses the construction, manufacture, delivery and erection, installation, commissioning and testing of all process, mechanical, civil, electrical, instrumentation and control plant.

Contract conditions are in accordance with the Institution of Civil Engineers GC 7th edition as amended by Severn Trent, with an agreed pain/gain mechanism.

Project description

The proposed new works will comprise an interstage screw pumping station, ASP distribution chamber, 4 lane 2 pass fine bubble diffused air aeration tank (75m long x 50m wide x 5m deep), HST blower installation, 4No. 27m diameter final settlement tanks (FSTs), FST distribution chamber, RAS/SAS pumping station, scum, washwater, and storm pumping stations, storm tank cleaning and GRP control kiosks for the ASP, sludge and storm tank MCC's.

A new SAS thickening/sludge blending facility will be provided comprising, SAS buffer tank, thickener feed pumps, thickeners in a steel framed clad building, thickened SAS/primary sludge

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Sanitaire Europe *provided the fine bubble diffused aeration system to* ***Monkmoor WwTW*** *and are the framework suppliers to* ***Severn Trent Water*** ***Thames Water*** *and* ***Scottish Water***

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blending tank, consolidated primary/imported sludge transfer pumps, digester feed RAM pumping station, SAS liquor return pumping station, odour control plant and control kiosk serving this area.

The existing site electrics will be significantly improved with provision of an upgraded 500 KVA transformer for the existing works, and a new 1250 KVA packaged sub station to supply the new plant. The existing distribution panel in the administration building will be replaced and the workshop will be completely rewired. A new emergency diesel generator (rated 1250Kva) will be installed to guarantee a power supply to the works.

Noise impact
The new pant has been designed to minimise any noise impact on local residents by locating equipment away from the housing estate where possible and providing acoustic enclosures as recommended by the noise simulation model.

Health & Safety Initiatives
A number of Health & Safety initiatives have resulted from the close collaboration between Severn Trent, STW Engineering (previously Haswell Consultants) and Biwater, which will improve working practices for the operators during maintenance of equipment such as:

* permanent ASP drain pipework installed to eliminate overpumping, thus saving cost and avoiding handling of diesel pumps with large diameter hoses;
* polymer IBC's will be moved on a bogie & rail system;
* sludge treatment building layout improved and adopted as a template design;
* elevated platforms have been added to the final settlement tank scraper bridges in lieu of access ladders;
* stop log storage frames with lifting davits for ease of operation;
* submersible pumping station valves installed at ground level to avoid chambers with associated access problems;
* blower air filters installed at ground level to improve safety during routine replacement;
* flowmeters due to be buried moved above ground for improved maintenance;
* consolidated sludge RAM pump power packs moved out of basement and installed on mezzanine floor above for improved access.

Construction
The new works is being constructed on land adjacent to the old plant and so having plenty of room to work on site the decision was made early to work on all the major structures together. This involved utilising 4 crawler cranes on site together with the usual earth moving equipment. A drainage system was installed first around the site to deal with all the groundwater, this being pumped through settling tanks, discharging back into the ground at the lowest corner of the site, all in agreement with the environment agency. All encountered groundwater was pumped into this system.

Construction of the ASP was straightforward, with concrete for the 600mm thick base slabs and the 500mm walls pumped. This structure stand 3 to 4m out of the ground with up to 2m buried. Wall shuttering was made up into crane handled panels utilising Ishebeck panel systems. The rebar was made up into large mesh panels and lifted into position by crane to minimise working at height.

The FST's were more difficult to construct owing to a floor slope of 20 degrees. This meant the hoppers were some 6m below ground level and so well into the water table. Deep wells were sunk at each

ASP Blower air main *photo courtesy Biwater Treatment Ltd*

Sludge Ram Pumps *photo courtesy Biwater Treatment Ltd*

hopper, water being pumped into the drainage system throughout the tank construction. This kept the excavations dry and by utilising 4m diameter shaft rings as a permanent back shutter were able to construct the hoppers safely without the need for sheet piles.

Consideration was given by the whole site team in the design of the rebar to eliminate being impaled if slipping on the steep slope. This included casting vertical bars into the hopper cone walls and then cranking them down the slope when they were needed. This provided both a barrier to prevent anyone falling into the hopper and prevented being impaled in the event of a slip.

The base slabs were pumped, utilising a roller striker fixed to the flange on the inlet pipe in the centre of the hopper. Stop ends were formed using exmet permanent formwork and all construction joints utilised retarder and then jet washed to alleviate Hand Arm Vibration (HAV) usually associated with the use of scabblers. Wall shutters were purpose made out of steel and the walls were poured full height, incorporating the launder channel within the wall.

The use of Viking Johnson wall couplers on all structures greatly reduced the programme time and the unsightly look of box outs. Pipework was started early to take advantage of the weather and. hence, was connected up to each structure as they became available.

\Wildlife conservation

There are several lagoons in a wildlife conservation area on the South East boundary, these will be fed with a sweetening flow of final effluent controlled by manual penstocks in the new outfall chamber. A number of initiatives are being investigated with Severn Trent's Environmental Department, to improve the facilities.

A Protected Species Survey identified the presence of great crested newts and badgers on the site, so prior to the start of construction, enabling works were undertaken comprising amphibian fencing for newt trapping under licence from DEFRA and badger set closure

Progress

At the time of writing, construction work of the reinforced concrete structure is complete, with some 12,000m^3 of concrete and 1.000 tonnes of steel being utilised. A traffic management plan was approved to control the large number of vehicle movements and no complaints were received from residents despite the increased volume.

Mechanical installation of the equipment is ongoing with forecast completion for the end of March 2006. The MCC's will be delivered in February/March to allow electrical cabling and software testing to commence.

The high voltage works will be undertaken during Spring 2006, to allow dry and wet testing to be undertaken during the Summer. Process commissioning will be complete by December 2006, to allow the demolition phase to be completed over the Winter, with a contract completion by March 2007.■

Note: *The author of this article, Richard Thomson, is Project Manager, Biwater Treatment Ltd*