Taunton STW

major upgrade to largest sewage treatment works in Somerset as part of a staged set of improvements

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Taunton STW serves a population equivalent of 85,000 in Somerset. With significant new developments, these population figures are projected to increase substantially in the coming years and so Wessex Water has embarked on a series of updates and improvements totalling £26m. In the current project, construction is under way to provide plant to increase the DWF and provide for consent tightening in line with NEP requirements, provide a new digester and construct a new 1 km long access road.

Aeration Lanes - Courtesy of Balfour Beatty

Current treatment

The current STW comprises an inlet pumping station and balancing tank, coarse and fine screens with detritor, primary settlement tanks, a conventional activated sludge plant (ASP), biological filter beds, humus tanks and final lagoons. In additional to treating the incoming sewage flow, some trade effluent is accepted but is limited in volume by the poor access roads.

Scope of construction works

Approval has been given to constructing a new 4-lane ASP to replace the existing 16 (No.) biological filters to enable the process to meet the increased dry weather flow and consent tightening. The existing ASP and filter process allowed for rebalancing of flows to enable a lagoon and four of the filters to be taken out of service and construction works to take place in these locations.

The reusing of land allowed the new works to remain within the existing site boundaries enabling most works to be constructed under permitted development rights. Planning permission was sought for 3 (No.) plant kiosks and a building for an HV substation.

The new works has been designed to meet the following consent conditions:

- Dry Weather Flow (DWF) 30,595 m^3/d
- Look Up Table (95%ile) BOD:SS:AmmN 15:30:3 mg/l
- Upper Tier BOD:AmmN 50:20 mg/l

Alongside the increase in aeration capacity, 3 (No.) additional final settlement tanks are being constructed. Minor works have also taken place within the inlet works to increase flow capacity.

The screens have been replaced with two units, each suitable of handling 905l/s. A replacement final effluent washwater booster set will be installed taking effluent from the new ASP to meet the increased needs of all plant around the site.

To accommodate the increased loads and to provide a greater resilience the HV ring main around the site is being reinforced with the addition of 2 (No.) LV generators capable of supplying the entire site. The generators will also be used for load management.

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The new works comprises:

- Replacement inlet screens.
- Combined ASP Feed and RAS pump station.
- ASP with anoxic selector chambers – total aerated volume of 14,000m^3 provided in 4 (No.) lanes. Each lane 81m in length, 6m wide with 6m water depth.
- 3 (No.) final settlement tanks, 31m diameter with 3m side wall depth.
- SAS pump station.
- Replacement FE washwater booster set.
- Upgrade to HV power distribution ring main and transformers.
- 2 (No.) 1,500kVA LV generators and step up transformers.

Other works associated with the scheme included site infrastructure upgrades, MCC, instrumentation and SCADA ring main.

Design is nearing completion and commercial activities are under way for a new digester complete with ancillary plant, all of which is planned to be completed by March 2015.

The construction of a new, 1 km long, access road from the nearest main road is also to be undertaken by March 2015 subject to land acquisition. This will enable greater traffic volumes and consequently increased use of the STW for intake of sludge from other Wessex Water STWs within Somerset. Further works are being planned following construction of this road.

Construction of major structures

The construction commenced on site in September 2012 and in February 2014 reached a significant milestone - the completion of the major concrete structures. The enabling works for the project were carried out between September 2012 and March 2013 involving the excavation, recycling, storage and reuse of materials, helping to achieve a 100% project recycling objective and zero waste to landfill target.

The completed excavations and earthworks provided a sound formation for the construction of the new ASP, three new final settlement tanks (FSTs) and their ancillary structures.

The ASP structure is divided into four new aeration lanes with full inlet facilities, incorporating a pump station, inlet and anoxic zones and controlled flow outlet chambers. Flows will be intercepted at the existing works and gravity fed via an 800mm diameter pipe to the new ASP pumping station. The structure of the new ASP was completed with over 4,500m^3 concrete and 390 tonnes of steel reinforcement, before being made available for the mechanical & electrical components, including aeration equipment, access stairs, gantries and walkways. These elements will provide locations and positions for electronic control systems.

The 3 (No.) 36m diameter FSTs including cantilever launder channels and weir walls, were completed in December 2013. The FSTs have their own desludge chambers. The FST structures were constructed with over 2,200m^3 of concrete and 400 tonnes of steel reinforcement.

Energy saving

A theme common to all Wessex Water sites is the need to reduce energy requirements on sites, together with additional generation where feasible. An earlier project in 2010 at Taunton STW installed and commissioned 2 (No.) CHP units and these have now been running successfully for some time. The new digester will provide more biogas for yet further electrical generation.

With the new ASP plant, the energy consumption would inevitably increase. The opportunity has been taken to improve the energy efficiency of the aeration system in 2 ways, namely:

Taunton STW - Courtesy of Balfour Beatty

Final settlement tank - Courtesy of Balfour Beatty

New aeration lanes at Taunton STW under construction Courtesy of Balfour Beatty

Rural construction - Courtesy of Balfour Beatty

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The machines are controlled via a separate module control unit (MCU) rather than via the main works PLC although each unit communicates with the other via a comms link. The MCU controls the number of blowers to run and the speed of the blowers to attain the best efficiency for that set point.

Focus on energy management has also been given further consideration to the process control of the aeration system which utilises both conventional dissolved oxygen setpoint control for each aeration zone and also a second system of advanced nitrification control designed and installed by Hach Lange.

The N-RTC consists of a common real time controller optimising nitrification processes in the aeration lanes taking account of the treatment variables measured across the process train. The controller calculates DO set points and delivers them to the PLC, where algorithms for blower control and DO control are implemented.

Implementation

Wessex Water has adopted a 'workstream' approach for the delivery of schemes in AMP5, and the overall roles and responsibilities of the partners for this scheme are as follows:

- Halcrow Group (now CH2M Hill): Outline and detailed design.
- Dean & Dyball Construction (now Balfour Beatty Regional Civil Engineering): Civil engineering construction services. Also Principal Contractor for the scheme.
- Nomenca: M&E procurement and installation.
- Wessex Engineering and Construction Services (WECS): Automation, Commissioning and Environmental Services.

The project presented a number of challenges. Most of the surrounding land is rural with the public road to the site being less than satisfactory to carry the construction traffic. The site is within the flood plain of the River Tone and situated in the Somerset levels which were subjected to well-publicised flooding during the project.

Work commenced on site in September 2012 and the project is on track for completion in March 2015. The interfacing with existing operational assets and the constrained access to the site influenced the construction programme.

The main structure was substantially completed by April 2014 and M&E installation commenced in May 2014. Dean & Dyball and Nomenca have been working closely together in order to coordinate their on-site activities.

At first sight, the project may appear straightforward but the sheer size of the construction within a tightly constrained rural site has necessitated close cooperation between construction partners and this has been key to maintaining programme.

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