

Gowerton WwTW

upgrade work to meet consents

Gowerton WwTW treats wastewater from a 60km² combined sewerage catchment in the North Gower area of South Wales. The works receives influent from a population equivalent of 77,000, of which approximately 10% emanates from trade. Treated and storm effluent is discharged into the commercially sensitive Loughor Estuary, upstream of shellfish beds. The estuary at this point is designated as a Special Protection Area, a Special Area of Conservation and a RAMSAR site.



Gowerton WwTW: Upgrade in progress

courtesy: Welsh Water Alliance

Existing works

Crude sewage entering the existing works is screened to 10mm in one dimension and then degrittied. During storm events, 25mm spaced bar screens are brought on line for the additional flows. Degrittied sewage is pumped to primary settlement tanks and in wet weather, also to the storm tanks. The settled sewage gravitates to secondary treatment consisting of a 6-lane nitrifying activated sludge plant with anoxic selectors, upgraded in 1999 to ensure complete nitrification. Flow from the aeration lanes gravitates to flat bottomed circular settlement tanks. Return activated sludge is removed from these tanks by 'organ pipe type' sludge scrapers and is pumped back to the aeration lanes. Surplus activated sludge is co-thickened in the primary settlement tanks and the removed sludge is thickened and digested. Digested sludge is held within secondary digesters for ten days to achieve a "treated" product standard. Compliant sludge is then dewatered and the cake used in agriculture.

Drivers for upgrade

In AMP3 the works was upgraded to meet legislative requirements as follows.

Urban Wastewater Treatment Directive for nitrate sensitive waters.

- * A works that serves 10,000 to 100,000 PE must achieve either an annual average of 15mg/l of Total Nitrogen from 24 composite samples or 80% nitrogen removal.

Shellfish Directive.

- * The works effluent is subjected to disinfection to achieve a faecal coliform kill. The storm tanks must be limited to less than 10 spills per year.

The upgrade will also resolve major compliance and maintenance issues such as:

- * poor flow splitting to the aeration and final settlement tanks;
- * lack of adequate screening causing blockages on the final settlement tank desludge pipes leading to problems with sludge blanket control;
- * infrequent manual wasting from the secondary process causing poor mixed liquor solids control. With the variation in solids control the peak solids flux loading is as high as 9kg/m²/d. Combined with a rise rate of 1.28m/h this causes solids consent issues;



* when a storm event starts, there is a step change in the flow to the aeration lanes increasing the solids loading onto the final tanks. As the solids withdrawal from the tank is fixed the sludge blanket rises to compensate for the imbalance between the mass in and out of the final settlement tank, putting the final effluent quality at risk.

Work undertaken

All the screens on site have been replaced with *Parkwood Escalator* screens (6mm aperture) supplied by *Longwood Engineering Company Limited*. The screenings material passes into a *Huber Rotomat* Screening Handling Unit for washing and dewatering before removal from site.

Secondary treatment has been modified from a conventional nitrification plant into a Step-Feed Nitrification/Denitrification plant by the addition of two anoxic zones, each of 1000m³, some modifications to pipe works and processed flows, aeration control changes and an inter-stage pumping station. The design was completed by modelling the existing works using *Envirosim Associates BioWin32 Process Simulator (Version 1.2.1)* and then calibrating the model using data collected during summer and winter flow and load surveys. The works was then split into two stages:

- * the two new aeration lanes as stage 1 process;
- * four old lanes as stage 2 process.

This set up gave the easiest way to solve the flow split problems with the final tanks. Anoxic zones were added to the model in front of the aeration stages with confidence of the results from the calibration runs.

The step feed process was chosen to allow a reduction in the solids loading onto the final settlement tanks. Given the carbonaceous oxygen demand to nitrogen ratio in the settled sewage, there was little point in increasing the size of the anoxic zones beyond that

required to consume the biodegradable carbon in the sewage. Thus, steady state model simulations with various additional anoxic volumes were completed until the model achieved an average of about 13mg/l Total Nitrogen in the effluent. A small volume was added to that predicted by the model to allow for de-oxygenation and in stage one, to allow complete mixing of the solids, centrate and return sludge prior to the flow entering the anoxic zone.

A 500m³ centrate balancing tank has also been installed as under dry weather conditions the centrate could account for up to 40% of the nitrogen load to the bioreactor.

Three Trojan UV 3000plus units (50% standby capacity) were supplied installed and commissioned by *Sunwater Ltd* for disinfection of final effluent based on a measured applied dose of 32mW.s/cm².

Under the Dwr Cymru/Welsh Water Shellfish Strategy the Loughor Estuary Shellfish water was modelled by *Metoc* to enable the water company to deliver the best environmental improvement to the receiving water with the money available. The EA agreed from this that the 10 spills criteria could be relaxed to 22 spills by bringing on line two existing tanks.

Black & Veatch Ltd completed process, mechanical, electrical and civil design. The civil partner was *Morrison Plc* with the mechanical installation completed by *Celvac Environmental Solutions* and *W. Walters Engineers Ltd*. *Lloyd Morris Electrical Ltd* completed the electrical installation and *General Panel Systems Ltd* supplied the panels.

Flows were turned into the new anoxic tanks, centrate tank, additional storm volume and UV process in September 2004 and the screens were completed in October 2004. This was five months ahead of the consent date of 31st March 2005. ■

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