Whitchurch WwTW

programme of improvements to meet new EA consent and habitats drivers

by Dr David O'Malley & Simon Cady

In October 2009 work commenced on a £4.7 million scheme for Dŵr Cymru Welsh Water at Whitchurch Wastewater Treatment Works (WwTW). This project was a programme of improvements to a medium-sized treatment works located in the traditional Shropshire market town of Whitchurch. The works currently treats sewage from a population equivalent (PE) of 9,700. It is estimated that the future PE will rise to 12,240 – based on a design horizon of 2025 – and this criteria has been implemented as the basis for the design.

Overview of the tertiary treatment plant at Whitchurch WwTW. This shows the new recirculation pumping station, liquor return PS, tertiary MCC, and sand filters in the background, far right - Courtesy of Imtech Process

The existing works

The work was undertaken in order to comply with the proposed new EA consent and Habitats drivers. Prior to the project's commencement, the existing works' process included primary settlement, biological filters and humus settlement, consented to treat 113l/s.

The inlet works consisted of an escalator screen, which screened all flows to treatment, and a grit removal system. There was also a primary settlement tank, with de-sludging via a peristaltic pump. The system incorporated 8 (No.) Biological Trickling Filters, four of which have stone media, with the remainder furnace slag. They run in parallel, therefore all the flow to treatment must pass through all the filters. The filter arms were hydraulically driven by the reaction of the flow out of the arms. There were 4 (No.)humus settlement tanks – each being de-sludged via a common Monsal airlift system – and recirculation was from the final effluent recirculation chamber. Thickening was achieved via the sludge beds and the liquors returned along the humus sludge to the primary tank for co-settling.

Technical description of the improvement programme

Under the improved system, inlet flows up to 70l/s flow into the works, controlled by an actuated modulating penstock. Flows above 70 l/s now spill through a new 6mm storm screen and discharge into the existing storm tanks. The storm tanks each incorporate a mixer pump, to clean the tanks upon drain down. The flow to treatment will be screened through either of two duty 6mm escalator screens and then continue through the existing grit removal system. Both of these screens incorporate an upstream actuated penstock to isolate the standby screen when it is not in use. Before the flow enters the PST inlet chamber, it passes through an existing MCert flume, which records the flows and also provides the main control via an automated penstock for the site's operation

The flow then passes through the PST inlet chamber, where the initial ferric dosing occurs. This chamber incorporates a flash mixer, to aid the percipitation of the ferric with the effluent. The ferric dosing is controlled by a diurnal pattern and flow relationship of the incoming flow from the MCert flowmeter. A new de-sludge pump provides effective de-sludging of the PST, using the existing gravity pipe to convey the sludge to the sludge reception well.

Biological treatment

For the effluent's biological treatment, the flow from the PST passes through the effluent channel in four first stage filters, will percolate through the filters and then flow into two intermediate settlement tanks and on into the second stage pumping station. The pumps forward the effluent onto the second stage filters at a flow rate equal to the flow entering the pumping station, which is controlled on level. The effluent percolates through the second stage filters and passes through the final effluent channel, where secondary ferric dosing occurs. The resultant dosed effluent passes into the remaining two final settlement tanks and into the Tertiary treatment pumping station. The pumps forward the effluent to the sand filters, again at a flow rate equal to the flow entering the pumping station and once again controlled on level. De-sludging of the humus tanks

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View from the top of the covered continuous backwash sand filters *Courtesy of Imtech Process*

in the improved system has remained on the existing Monsal airlift system and flows via gravity to the sludge reception well.

Dosing plant

A ferric dosing plant, housed in a bunded kiosk, provides storage for 30m^3 of Ferric Sulphate. The bund is sized to retain 110% of the maximum volume stored in the tanks. Duty/standby pumps will dose to each of the primary and secondary dosing lines. These dosing lines are installed within secondary contained pipe, to contain any leaks. Tertiary treatment consists of 4 (No.) above-ground continuous backwash sand filters. The effluent passes up through these filters, removing fine particles as it percolates through the sand. A compressed air system continually lifts sand for cleaning. Downstream of the filters, a washwater break tank provides 2m^3 volume of positive head final effluent for the washwater booster, which is set to distribute across site to the hydrants and screens when it is needed.

The final effluent leaves the washwater tank and flows into a new final effluent chamber. The weir within this chamber ensures the flows diverted to the new recirculation chamber are maintained, before the final effluent enters the outfall. The recirculation pumps provide recirculation to the PST inlet chamber at a flow rate equal to the FFT (70l/s), minus the incoming flow rate, thereby ensuring the required wetting onto the biological filters. The existing sludge beds were retained for dewatering the sludge. The existing sludge pumps convey the primary and humus sludges from the sludge reception well to the drying beds, for decanting. The decant liquors continue to be managed manually by the operator.

Liquor return pumping station

At the Liquor Return Pumping Station, return liquors from the drying beds and sand filter back wash is diverted to a new liquor return PS. This passes forward the liquor to the PST inlet chamber. When this pumping station returns liquors to the PST inlet chamber, the recirculation pump's flow will be reduced by 10l/s. Housed in a GRP kiosk, a new substation was installed at the top of the works. Adjacent to this there is a new LVDB, also housed in a kiosk. This provides power and control for the new equipment at the inlet works, PST and primary ferric dosing area, plus the storm tanks. A third kiosk, housing the main Tertiary MCC, was located next to the tertiary treatment area. This provides the power and control for all the equipment associated with the humus tank area, ferric dosing plant, tertiary treatment area and recirculation and liquor return pumping stations.

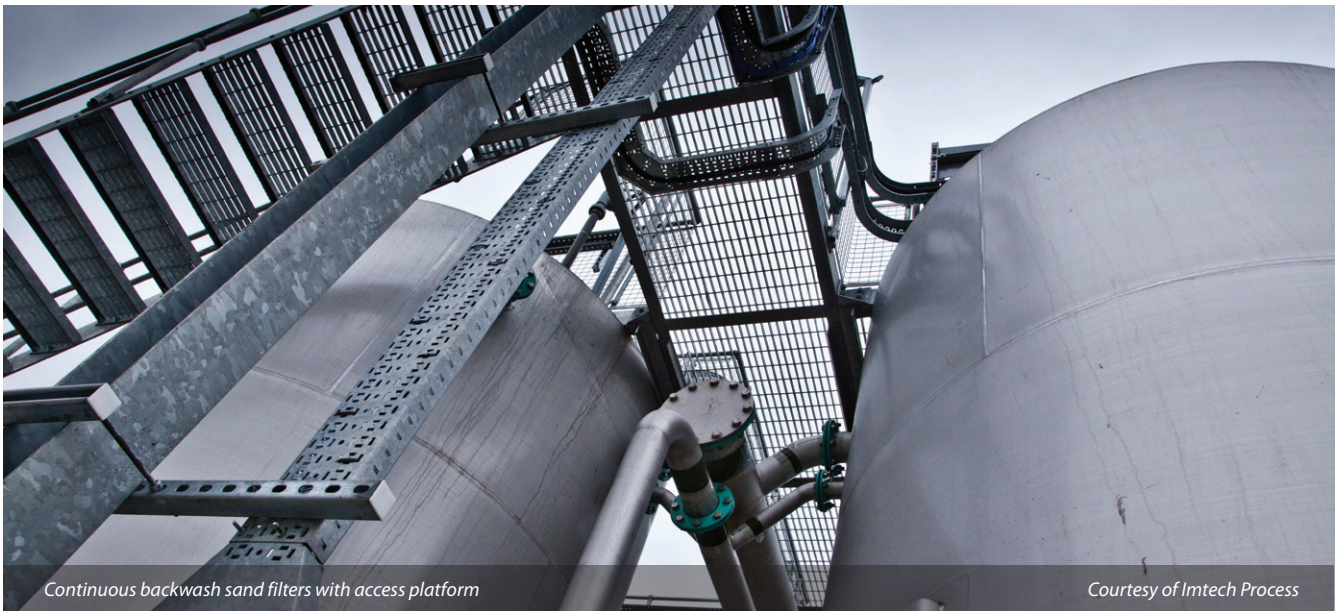
Residual benefits of the improvements

The work was carried out to meet the proposed new EA consent and Habitats drivers. The primary driver is a requirement to comply with the habitat quality imposed by the EA. The particular drivers are F1a and H5. The H5 driver imposes requirements for removing phosphorous, thus meeting the Agency's strategy on Eutrophication. The F1a driver imposes requirements to achieve standards compliant with the Freshwater Fish Directive. This means at Whitchurch the consent will tighten from 32mg/l BOD, 55mg/l TSS to 10mg/l BOD, 15mg/l TSS, 3mg/l Amm.n & 1mg/l TP.

The introduction of the new consent will provide an opportunity to re-consent the works, based on recent population counts and

Ferric sulphate dosing & storage installation supplied by Gee & Co. Chemical dosing used for the reduction of phosphorus - Courtesy of Imtech Process

New MCC controlling inlet works and storm handling Courtesy of Imtech Process



Continuous backwash sand filters with access platform *Courtesy of Imtech Process*

a reduction of Industrial effluent discharges within the catchment, effectively reducing the current consent from 113l/s to 70l/s. The secondary driver, which is less impacting, is the improvement and modernisation of this works and its assets, to increase their life span and optimise performance.

The EA has introduced another consent limit on the Fe within the final effluent. This could be restricted to 5mg/l with a two year hands-off period. Following this elapse it could be further reduced to 1mg/l. The design is based on 5mg/l. The proposed scheme was executed under the AMP4 Investment Programme, with delivery of these outputs programmed by 31st March 2010.

Undertakings

The principle contractor for the initial civils work was Costain, with Imtech Process taking over the role to complete the M&E installation and plant commissioning. Construction on the project concluded in July 2010. The scheme is now operational and meets the new directives.

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Whitchurch WwTW: 4 (No.) continuous backwash sand filters treat 70 l/s to meet the consent of total suspended solids of 10 mg/l - Courtesy of Imtech Process