

Eign WwTW

high rate filter replacement

Eign WwTW is situated on the outskirts of Hereford and discharges into the River Wye. The works is linked to the Rotherwas WwTW with all flows arriving at the Eign WwTW and then being split typically 33:67 between Eign and Rotherwas WwTW's for treatment. The total population equivalent (PE) for Eign and Rotherwas is 113,724 split between trade and domestic waste. The Eign WwTW influent is subject to seasonal changes in load with a significant increase from September to December due to a trade discharge from a well know cider manufacturer during the apple-processing season. During this period there is typically a 35% to 50% increase in biological load. Plastic Media High Rate Filters (HRF's) were originally installed at both Eign and Rotherwas to supplement the existing conventional biological rock media filters and specifically treat the high seasonal loading from the cider manufacturer. In November 2005, after approximately 4 years of operation, there was a media collapse and major structural failure of the HRF at Eign, putting the process out of action This failure left the works with a major treatment capacity problem, which needed to be resolved before the next high load cider production season in September 2006.



Eign: The High Rate Filter under construction

courtesy Dwr Cymru Welsh Water

An investigation into the HRF failure agreed revised Welsh Water design standards for future new HRFs that would ensure there was no repeat of this incident. An agreement was then reached in mid April 2006 to build 2 new HRFs and associated pumping systems with a treatment capacity to robustly meet the peak biological load at the Eign works.

Against an extremely tight programme, the South East Team consisting of Welsh Water's Alliance Investment partners AMEC and *Imtech Process* and operating partners Kelda Water Services delivered the £3.74m scheme on time for the increase in biological load in Autumn 2006. Throughout the construction period Kelda, with support from *Imtech Process*, effectively managed the reduced treatment capacity at Eign to maintain final effluent consent

compliance at Eign and Rotherwas. Close liaison was also maintained with the Environment Agency (Wales) who were kept fully informed.

The scheme

The scheme comprised the design, construction and commissioning of 2 new 21.5m diameter prefabricated concrete 'A' Consult Tower Filters, inlet and outlet pumping stations, intercept chamber and all interconnecting pipework, ductwork and ancillary structures. Mechanical, Electrical and Control equipment was provided to suit the above, including: power supply, MCC and all site cabling, pumps, powered filter distributors, 3700m³ plastic media, access steelwork and all ancillaries such as actuated valves, flow-meters, potable water booster system, pipework, site lighting etc. The scheme also included the dismantling of the old High Rate Filter and associated pumping station.



Completed High Rate Filter

courtesy Dwr Cymru Welsh Water

Design

The basis of design for the High Rate Filters was to remove over 65 per cent of the settled BOD load at peak influent loading to allow the secondary rock media filters to achieve full nitrification, thereby meeting the effluent consent of 15 mg/l. In order to achieve this level of treatment, the filters were sized on a peak biological loading of 1.6kgBOD/m³media.d. Each filter was filled with 2H structured cross flow poly-propylene plastic media that provided a very large surface area for biomass attachment, each m³ of media had an effective surface area of 125m² giving an effective surface area for each filter of over 230,000m². The media in the filter was supported on dwarf walls to ensure the effluent could drain freely back to the Humus (outlet) Pumping Station from where it was lifted to the pre-existing humus tank for settlement.

With the correct wetting of highly loaded plastic media filters crucial to their operation to control biomass levels and ensure good biological removal efficiencies. The Eign HRF design allowed for 1.4m³flow/m²hr onto the filters at all times. This was achieved by automatically re-circulating flow from the settlement tank back to the filter feed pumping station whenever the inflow to the Eign works was insufficient. Due to the large void area within plastic media filters and the high biological loading it was essential to control the biomass levels in the filters. Imtech Process and 2H designers worked closely to design effective methods of control to ensure that excessive solids were flushed out of the filter. Once per day the wetting rate was increased to 2.8m³/m².hr by stopping the flow to one filter and doubling the flow to the other to control biomass build up within the filter by “sloughing” off the excessive solids. In addition to this, several times a day the distributor arms were slowed down to increase flushing intensity.



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One of the many challenges overcome was to ensure effective, controlled and even distribution of the wastewater onto the filter to achieve the design requirements for flushing off the solids from the filters. Tuke & Bell worked closely with *Imtech Process* designers from the initial design stage to ensure that the specific requirements of slow operational rotation speed and flushing speed for this project could be met. This included several modifications to their existing design, which meant that the manufacture and installation time became crucial to the success of the project. The distributors were variable speed, electrically driven arms that operate at 7.1 revolutions per hour at 145l/s under normal conditions. The two “flushing” modes of operation were 7.1 revolutions per hour at 290l/s and 1.8 revolutions per hour at 145l/s.

The scheme was ‘fast tracked’ to meet the tight programme. Detailed design started in earnest late April with Tier 1 civil designers Atkins Water and *Imtech Process* designers focusing on critical path design activities. At the earliest opportunity build-ability reviews were carried out by AMEC construction team with mechanical and electrical sub-contractors, *Industrial Pipework Services* and *Oasis Electrical Engineering* respectively being brought on board early.

On site construction started in May and flows were turned on 20th September in time to seed the filters for the imminent load. Due to the efforts of all involved, this was four weeks ahead of the original programme with Eign meeting its consent and able to treat the high loads from another cider production season. ■

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