Melbourne WwTW

a different approach to meeting a new consent

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CostainMouchel was tasked by Yorkshire Water Services (YWS) with the design and construction of an upgrade to the existing Melbourne Wastewater Treatment Works (WwTW) to meet the new STQ Habitats consent. The £1.86m scheme was implemented under the AMP4 Agreement with Yorkshire Water, which is structured to drive innovation in design and construction. The scheme highlights the approach taken to supply an innovative, cost-effective design to tight timescales.

Primary balance tank with scraper bridge plus primary balance tank pumps *Courtesy of CostainMouchel*

Melbourne WwTW is located in a rural setting near the village of Melbourne in East Yorkshire and receives pumped flows from the villages of Bielby, East Cottingham, Melbourne and Seaton Ross. It required upgrading by March 2010 to meet a revised final effluent discharge consent of <1 mg/l Total P on an annual average basis, under the EU Habitats Directive.

The existing works consisted of

- Screening of incoming flows
- Primary settlement in two Dortmund-type tanks
- Biological treatment provided by three mineral media biological filter
- Secondary settlement provided by two Dortmund-type tanks
- Tertiary treatment of part of the flow and blending with humus effluent to meet the consent

It is required to treat the following future flows, loads and consents for a design horizon of 2020:

Population Equivalent	2733
Daily Average BOD Loads	164 kg/day
Daily Average Suspended Solids	180 kg/day
Daily Average Ammonia Loads	21kg/day
DWF	635m³/day (7.35l/s) WW1 – 623m³/day
Formula A	2974 m³/day (34.4l/s) WW1 – 2584 m³/day
FFT	3664m³/day (42.4l/s)
BOD	20 mg/l
SS	50 mg/l
Ammonia	10 mg/l
Phosphorus	1 mg/l

Approach
The first step was to fully understand the flows and loads to be processed by the treatment works. The existing works were consented to treat all flows from the combined catchment. A change to the flow consent to allow any form of storm water overflow was not acceptable, so treatment of the full flow was still required. The terminal pumping stations were established fit for purpose, having no reported flooding problems in the individual catchments, and together delivered a peak flow of 43l/s. Surveys of the catchment confirmed the design population and the degree of separation in the catchments.

Possible treatment options to achieve the new consent were agreed with YWS and then evaluated based on CAPEX and Whole Life Cost. The long-term viability of aspects of the options was determined by power cost sensitivity. Following various risk and value challenges, a preferred option was selected.

Innovation
Whilst removal of phosphorus in sewage by dosing ferric sulphate in primary and secondary settlement is conventional, other areas of the works gave scope for cost-saving innovation.

With the addition of a new humus tank, the existing process stream was capable of treating the biological load and flows up to 15l/s, which approximates to 3DWF. The conventional approach would be to design the process stream for the peak flow of 43l/s. However, as the works, with the addition of the humus tank, would treat the peak dry weather flows (3DWF) and loads, the implemented solution provided for storage of storm flows, which are then returned to treatment during low incoming flow periods. The treatment works' catchment area was modelled using Infoworks CS with a series of rainfall files to represent a full year's storm conditions. On the treatment works, storage of these volumes is provided and the treatment process sized for 15l/s rather than 43l/s, so yielding a significantly smaller overall project solution while still meeting a tighter consent.

Tertiary sand filter unit in the background and humus tank in the foreground *Courtesy of CostainMouchel*

Only the central hopper of the Inlet Storm Balance tank is currently used for storage during dry weather flows. During storm condition, however, the base of the tank is flooded and subsequently requires cleaning to prevent septicity and odours. A half-bridge scraper was installed to ensure the base of the tank is cleaned during and after wet weather.

Due to the wide range of operating levels in the Inlet Storm Balance Tank, positive displacement pumps have been used to pass forward the flow to treatment. After initial reliability issues with diaphragm pumps, replacement ram pumps were provided.

Tertiary Sand Filters for the removal of ferric were sunk partially in the ground to lower the head on the pumps and reduce pumping power costs. By working with the equipment supplier, their standard filter design was modified so that standard precast concrete rings could be used for the construction of the vertical cylinders instead of using more complicated and costly shuttering.

Description of the completed treatment works:

- Existing inlet works. The scheme maintains the existing screen and at the same level to avoid impact on the terminal pumping stations
- The existing sludge storage system has been retained
- New Inlet Storm Balance Tank - circular concrete tank (840m^3) with rotation half-bridge scraper for tank cleaning
- New duty/assist/standby 7.5l/s each positive displacement pumps to pass flow to treatment from the Inlet Balance Tank
- Two existing Dortmund tanks with improved flow control and existing progressive cavity pumps for desludging
- Three existing Mineral Media Biological Filters with new drive systems
- New 5.5m-diameter, conical, GRP Humus Tank with diaphragm pump for auto desludging
- Uprated interstage pumping station, feeding the existing SAF and new Sand Filter
- New self-cleaning strainer to protect Sand Filter from debris
- The existing SAF is retained to treat 7.5l/s subject to further performance testing
- Two new, continuous backwash, sand filters to remove surplus ferric.
- New primary and secondary ferric dosing systems with profile and flow rate controlled dosing rates
- Septicity dosing was provided at the existing terminal pumping station due to long rising mains to the works

The Team
The project was delivered for YWS by the AMP4 Waste Water (East) Joint Delivery Team, which comprises YWS, Costain and Mouchel. All staff involved, working together as CostainMouchel, are co-located at offices in Castleford, West Yorkshire.

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