

Shepton Mallet STW

phosphorus removal under the Urban Waste Water Treatment Directive (UWWTD) and major capital maintenance investment

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Shepton Mallet Sewage Treatment Works (STW) serves the town of Shepton Mallet in Somerset. Flows and loads received by the works are dominated by trade effluent from the food and drinks industry. The STW already has a tight consent and the treatment process is sensitive to variations in load from the main trader in the catchment. Under the UWWTD the site requires phosphorus (P) removal to a level of 2mg/l by December 2013. The process enhancement required to achieve the proposed new P consent also needs to help improve the robustness and security of the process to achieve compliance under all conditions. The site is also highly odour sensitive with a history of complaints and EHO involvement.



New odour control unit - Courtesy of Grontmij

Background and scope

The existing works comprises coarse and fine inlet screens, grit removal, 4 (No.) high rate plastic media roughing filters, primary humus tanks, 6 (No.) plastic media and 2 (No.) stone media trickling filters, secondary humus tank, a biologically aerated flooded filter (BAFF) plant, recirculation pump stations, sludge holding and thickening, storm tanks, storm return pump station and an odour control unit.

An option study established that the preferred process option entails the provision of ferric dosing, tertiary sand filters and increased sludge storage. The ferric is to be dosed at two points to enable a proportion of the P removal to be accomplished after secondary biological treatment.

The existing odour control unit is undersized and has been bypassed because the head loss across the media is excessive and would restrict ventilation on the high rate roughing filters. The odour control fans are however in use, bypassing the media and venting to the atmosphere.

The high rate roughing filters which provide treatment prior to primary settlement, are in poor condition due to the high levels of Hydrogen Sulphide (H₂S). The scheme allows for replacing the plastic media, glass coated steel tanks, the GRP roofs and the refurbishment of the motorised distributors.

As part of the scheme the wash water system is to be upgraded to suit the new site requirements.

Delivery method

The schemes have been delivered by the Treatment 2 workstream with Wessex Water AMP5 delivery process. Treatment 2 comprises four partners; programme management (Wessex Engineering and Construction Services), design consultant (Grontmij), civil contractor (WECS Civils) and M&E contractor (Trant Construction Ltd). All partners have been involved during the outline design, detailed design and construction/commissioning phases of the project. Early contractor involvement has been a key element to the successful delivery of multiple treatment processes whilst maintaining site compliance.

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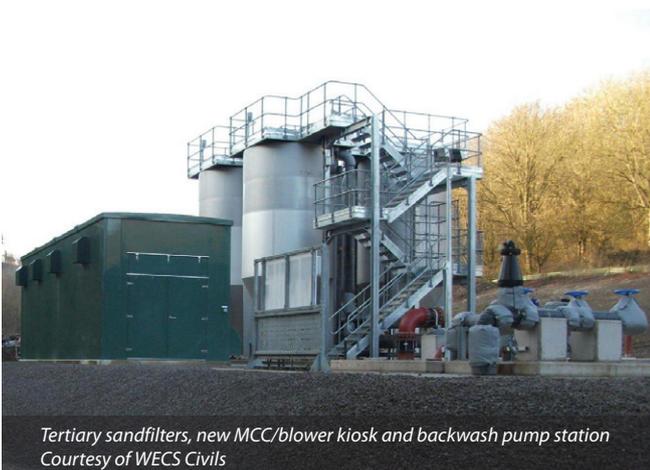
Ferric dosing plant being installed - Courtesy of Grontmij



Raw sludge tanks during construction - Courtesy of Grontmij



Completed raw sludge tanks - Courtesy of Grontmij



Tertiary sandfilters, new MCC/blower kiosk and backwash pump station
Courtesy of WECS Civils

P removal scheme

The scope of works was split into two schemes by Wessex Water, the first scheme to address the requirements for phosphorus removal and improve the process reliability of the site. The design brief for this package was issued to Grontmij to start outline design in November 2010.

The completed outline design was approved by Wessex Water in May 2011. Detailed design was then carried out between July 2011 and February 2012. The key elements entail: new ferric dosing plant, new tertiary sand filters with an associated feed pumping station and the extension of the raw sludge tanks incorporating a new feed pumping station and new sludge tank mixers. Construction started on site May 2012.

Ferric dosing plant: The new ferric dosing plant provides 30m³ storage in 2 (No.) tanks situated in a concrete containment bund. The Nomenca package plant incorporates 2 (No.) sets of duty/standby pumps that dose in two locations:

1. Upstream of the primary settlement tanks, via a 120m long dual containment dosing line.
2. Upstream of the new sand filter feed pump station, via a 160m long dual containment dosing line into a static mixer.

At various points in each chemical dosing line catch-pots are installed to detect and contain any leaks. The dosing lines are monitored for bursting and blockage by pressure gauges on the delivery pumps and a pressure loading valve at the point of application.

Raw sludge feed pumping station and sludge tank extension: The 2 (No.) existing raw sludge tanks provided 582m³ of storage and were gravity fed from the primary settlement tank de-sludge chambers. The installation of the new ferric dosing plant required the existing tanks to be extended in order to provide an additional 400m³ of sludge storage.

A structural survey carried out on the existing concrete tanks established that the top section of each tank had suffered severe H₂S attack. In order to extend the tanks it was required to cut the top 900mm of concrete off of the tanks sides walls. This provided a sound fixing for the new 12m diameter, 2.8m high glass coated steel (tri-fusion plus) tank extensions. The remaining concrete was coated to prevent future H₂S attack. The increase in the height of the tanks required the construction of a new 2.1m diameter; 3.3m deep raw sludge feed pumping station housing duty/standby raw sludge feed pumps.

Tertiary sand filters: The tertiary sand filter plant was sized to treat peak flows of 118l/s. A Hydro plant was chosen consisting of 4 (No.) upward flow 3m diameter sand filters with a sand depth of 2m.

Situated downstream of the existing BAFF plant, the sand filters reduce the suspended solids and associated BOD content of the BAFF effluent to ensure compliance with the consent. There was also the requirement for a new 3.6m diameter, 6m deep TSF feed pump station housing 3 (No.) submersible pumps operating duty/standby/assist and a new 1.8m diameter, 3m deep TSF backwash pump station housing duty/standby backwash pumps.

Capital maintenance scheme

The second scheme addressed capital maintenance issues on the site. The design brief for this package was issued to Grontmij to commence outline design in November 2010.

The completed outline design was approved by Wessex Water in January 2012. Detailed design was then carried out between February 2012 and July 2012. The key elements entail: a new odour control plant, refurbishment of the 4 (No.) roughing filters, upgrades

to the effluent washwater system and replacement of corroded access metalwork. Construction for these elements commenced on site October 2012.

Odour control plant: In order to provide design parameters for the new odour control plant an odour model was carried out by AMEC. This determined the current odour levels at the site and the odour dispersion to the surrounding area. The new odour control plant also provides forced ventilation for the roughing filters.

The new plant was sized to treat a maximum airflow rate of 22,000m³/hr. Several odour control suppliers' proposals were considered and as part of the selection process whole life cost comparisons were carried out. The chosen supplier was Plasticon Composites, whose odour control plant consisted of 2 (No.) 11m high biofilter vessels and a single carbon absorber that disperses treated air through a 12m high vent stack.

This offered the benefit of utilizing final effluent for the washwater supply to the biofilters as opposed to potable water while the biofilter media (lava rock/pumice) has a guaranteed working life of 20 years.

Roughing filter refurbishment: The existing high rate roughing filters are in poor condition and ventilation is abstracted from the top of the media making access to the distributors difficult due to the high levels of H₂S. Complete refurbishment of all 4 (No.) roughing filters was required including new tank walls, roof, media and refurbishment of the distributors.

The replacement tanks and roofs were supplied by Reliant and the support structure, new media and distributor by Sewaco. Under the refurbishment works the ventilation arrangement has been altered such that fresh air is drawn in down through the media, so that the odourous air is extracted from the bottom of each

filter. The changes to the ventilation arrangement required close cooperation between Plasticon, Sewaco and Reliant which was closely supervised by Grontmij and Trant.

During the refurbishment of each of the roughing filters a portion of flow needed to be diverted to an old balancing tank converted to a plastic media filter to ensure site compliance. This balancing tank filter is uncovered and had to be fitted with a temporary carbon odour control unit for the duration of the roughing filters refurbishment.

Washwater system: The existing effluent washwater system was served by a pair of obsolete submersible pumps. The pressure and flow requirements for the new odour control unit, the existing gravity belt thickener, the existing inlet works and an extended washwater standpipe system meant it was not possible or suitable to utilise the existing submersible pumps.

The new washwater system comprises a set of duty/standby low lift pumps which pump final effluent to a new break tank. Flow to the break tank is filtered to 150 microns (a design requirement of the Plasticon odour control plant) through an automatic backwash strainer. Washwater is then boosted around the site by a new set of duty/assist/standby variable speed multistage pumps.

Construction sequence

In order to meet the new P consent and carry out the required elements of the capital maintenance scheme while keeping the works fully operational a detailed construction and commissioning programme was developed by the whole team. The main constraints included:

- Commissioning the sand filters as early in the project as possible to give the site a more robust tertiary treatment stage.



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Sewaco Ltd have been working alongside Trant Construction, Wessex Water and GENoco to renew all four Roughing Filters on the Shepton Mallet STW refurbishment project

As part of this scheme the old (and badly clogged) PVC filter media material has been removed by Sewaco and transported to Wessex Water Avonmouth STW (GENoco) for recycling.

Sewaco are delighted to have worked with Trant Construction and GENoco to devise a recycling solution that works towards Wessex Water's aim of achieving Zero Waste to landfill by 2020.

Please contact Sewaco Ltd to discuss your biofilter media upgrade requirements and the recycling of any waste filter media arising from such work.



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- Extending the sludge holding capacity of the works before the start of ferric dosing.
- Refurbishment of each of the roughing filters in turn with the diverted flows treated by the balancing tank filter.
- Installation and commissioning of the new odour control unit prior to the commissioning of the first refurbished roughing filter.

Close co-operation was required between WECS and Trant on site to ensure that interim project milestones were met allowing the various elements to be commissioned as required. Close liaison was also required with Wessex Water operations to ensure that the site remained compliant with the consent during the entire period.

Zero waste initiative

Wessex Water has set a target to achieve zero waste to landfill by 2020. The Shepton Mallet schemes were selected as suitable trial projects under the 'zero waste to landfill' initiative. The construction scheme at Shepton Mallet has diverted more than 96% of waste from landfill by following the waste hierarchy.

This required both WECS and Trant to identify possible reuse or recycling routes for all of the wastes produced by the scheme. The greatest challenge was the roughing filters where it was necessary to dispose of approximately 1,200m³ of PVC media. Trant identified a recycling outlet for the old PVC media waste.

Working with Sewaco, who were responsible for the media disposal, options were appraised to clean a heavily contaminated waste product into a material acceptable for reprocessing. The media could not be cleaned at Shepton Mallet due to the site's inability to process the additional biological load.

A disposal route was negotiated with GENeco (Wessex Water's waste to energy business) to recycle the media at Avonmouth STW

in bulk form. Once transported to Avonmouth STW the PVC media is passed through a shredding/washing package and the gross solids/sludge treated by the works.

The cleaned PVC by-product is then delivered to the PVC recycling company who reprocess it into PVC Scaffold boards for reuse in the construction Industry.

Completion

At the time of writing this paper (June 2013) the tertiary sand filters had been commissioned since January 2013 and handed over to Wessex Water operations. The ferric dosing system, sludge treatment extension, new odour control unit, first roughing filter refurbishment and the washwater system are complete and under commissioning.

The second roughing filter refurbishment is currently underway and the remaining roughing filters are programmed to follow through to completion by April 2014.

The Treatment 2 partnership has been highly successful at Shepton Mallet STW and their early involvement during the whole design stage has ensured the smooth delivery of a complex scheme on time and budget.

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Refurbished roughing filter with new odour control ducting - Courtesy of Grontmij