Stanbridgeford STW

installation of biological, tertiary treatment to mitigate a potential ammonia problem

Stanbridgeford Sewage Treatment Works (STW), lies approximately one mile south of the village of Stanbridge in Bedfordshire and as of 2016, the population equivalent (PE) of the works was 15,305 and the domestic population served was 15,051. The treatment works discharge into the adjacent Ouzel Brook, a tributary of the River Great Ouse. Regulations from the Environment Agency (EA) state that the level of ammonia in wastewater must be less than 1mg/l for it to be discharged safely into waterways. Although nitrates are naturally occurring in water, excess amounts are detrimental to aquatic ecosystems; causing a rapid increase in the population of algae, which deplete oxygen levels in the water and release toxins. This can be fatal for marine life. Additional treatment systems were therefore required at Stanbridgeford to oxidise ammonia into less harmful nitrates.

Front view of the SAF units showing the outlet pipework, blowers and cable tray. The team incorporated concrete steps to the slab to allow safe access to the blowers during future maintenance - Courtesy of Barhale Ltd

Exiting works

The original facility mainly comprised primary and secondary sewage treatment. This consisted of 1 (No.) anoxic tank, 1 (No.) activated sludge plant and 3 (No.) final settlement tanks. Existing tertiary treatment included 1 (No.) tertiary submerged aerated filter (SAF) and existing iron dosing (ferrous sulphate) on-site for phosphorus removal (2mg/l consent or 80% removal).

New biological tertiary treatment plant

Barhale, working as part of Anglian Water's Integrated Operational Solutions Alliance, was engaged to install a new biological tertiary treatment plant at Stanbridgeford. This included:

- 12 (No.) SAF units (constructed off site).
- 2 (No.) 7.5kw pumps and 2 (No.) 11kw blowers.
- Motor control centre (MCC) panel and programmable logic controllers (PLC).
- Utilising the existing feed well and drying bed slab.

SAF units

The SAF units, supplied by specialists WPL, were to provide aerobic treatment of ammonia. Bacteria within the units carries out a nitrification process whereby ammonia in the wastewater is converted to less harmful nitrates. The SAF units were designed to remove nitrates to less than 1mg/l in order to meet the new Permit to Discharge consent before the water was discharged into the nearby brook. This ensured the treatment would meet the EA regulatory requirements of removing a minimum of 48% of the total ammonia annually, based on composite samples compared with the influent.

As a base for the new SAF units, a concrete slab was installed. During excavation, a watching brief was put in place as asbestos was known to be present in the spoil. This meant an approved asbestos contractor was present at all times and inspected the spoil as it was excavated, safely removing any asbestos that was uncovered. This was a time consuming process but was absolutely essential in order

to comply with current legislation and ensure the wellbeing of the site installation teams.

Innovative solution

In their component parts the elements utilised on this project were fairly standard pieces of equipment, the likes of which can be found on most STWs. The way in which the Barhale team brought the pieces of the plant together however, and some of the specific nuances of the design, made the solution particularly innovative.

Key to the success of this project was the interaction of the new plant with existing structures, pipelines and the process stream on site. In essence the team plumbed the new kit into existing kit. This required careful and thorough planning for each and every element, liaising with the asset owner, Anglian Water, throughout. Regular Plan for Stage meetings were held, during which time an in depth, step by step activity list was created. This close communication was of the utmost importance and successful coordination with both Anglian Water's operations and key supply chain members ensured that the treatment works remained operational throughout the project; maintaining unaffected service to customers. The Plan for Stage meetings also helped ensure the Barhale team flagged or removed unknown elements early on in the process in order to mitigate delays.

Modular design

By utilising a modular design and off site build, the team was able to bring the elements of the solution together very quickly, thus reducing time on site. Factory acceptance tests were carried out prior to delivery, meaning that the units could be positioned, installed and ready to receive flows within three days of arrival on site. In comparison, a traditional tank build and M&E fit out would have taken several months. This reduction in installation time was essential in enabling our team to start the commissioning and seeding process of the tanks as soon as possible, in order to meet their challenging obligation deadline.

MCC

Part of the build involved the installation of a new MCC panel. This managed process flow, as well as controlling various parts of the works and blowers accordingly. The software within the MCC was supplied by Paktronic Engineering Ltd.

The delivery team identified an opportunity to locate the new panel inside an existing site building, which removed the need to install both a new concrete kiosk base and kiosk, reducing both cost and time on site.

Biological media required less aeration

The final critical factor was that the site had a set level of supplied power. Not only would this have been costly to upgrade, but there was also insufficient time in the programme to facilitate a new supply being brought in to site.

As part of the delivery team's quality assurance they visited WPL (the manufacturer of the SAF tank) during the build process. By working closely with WPL, the team found that there was an innovative media, which could be placed inside the tank that would still receive the biological results, but due to its shape needed less aeration. This resulted in a reduction of the size and number of blowers required on site; which are generally very inefficient with regards power consumption.

This innovation ensured the new biological tertiary treatment plant could operate effectively, meeting EA regulations within the confines of the set power level for the site.

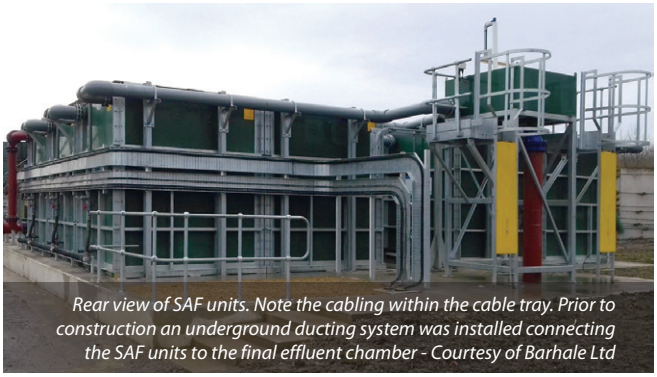
Seeding the units

Once the units had been fully installed, settled sewage from a nearby Water Recycling Centre was pumped into them. This settled

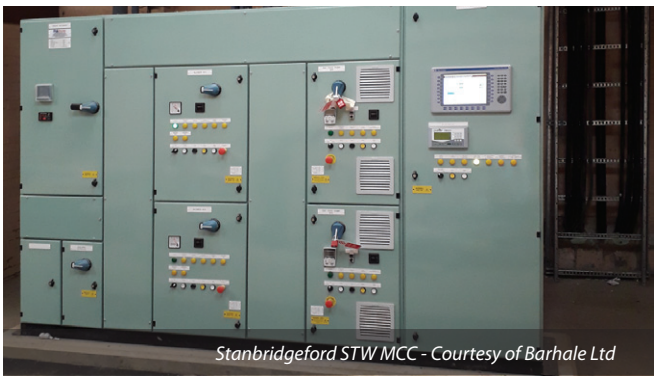
After being roughly laid, the concrete was levelled with the roller-screeder, reducing time and potential injuries - Courtesy of Barhale Ltd

SAF units being lifted into position using a 100t crane and bolted together in two banks of six - Courtesy of Barhale Ltd

SAF units with interconnecting pipework installed Courtesy of Barhale Ltd



Rear view of SAF units. Note the cabling within the cable tray. Prior to construction an underground ducting system was installed connecting the SAF units to the final effluent chamber - Courtesy of Barhale Ltd



Stanbridgeford STW MCC - Courtesy of Barhale Ltd

sewage, combined with the operational blowers, produced ideal conditions for 'early seeding'; these optimum conditions allowed the bacteria to grow on the media inside the SAF units. Once the bacteria had fed on the sewage and multiplied, it was able to remove ammonia from the final effluent.

Pipework

As part of the Stanbridgeford STW project, an additional concrete slab and plinths were installed to support new pipework from the final effluent chamber to the SAF units. Once the slab was completed and the pipework and valves were assembled, they were connected to temporary pumps which were supplied by Selwood Pumps Ltd. This meant that effluent could be pumped into the SAF units from the final effluent chamber before the installation of the permanent pumps.

The final stage of the project was to carry out final sampling and commissioning works on the new plant.

Savings

By reducing the size and number of blowers required on site, due to the use of an innovative biological media that required less aeration, the team saved on the initial cost of the upgrade and will also save the client on long-term operating costs. Furthermore, integrating new items of kit with existing structures produced a significant carbon saving along with a cost saving of £20k. The team delivered the project at a total cost saving of circa £894,460 (over 30%) on the client's original project affordability target.

Conclusion

Throughout this project the team provided a number of customer benefits through innovative design, planning and collaboration with their specialist supply chain. By choosing to locate the new MCC panel inside an existing building, the team saved on both the cost and the build time of a new kiosk base and kiosk.

Stanbridgeford STW Key Participants	
Management & design	Barhale Ltd & the IOS Alliance
Construction & design	Barhale Ltd
Ecology surveys	Greenwillows Associates Ltd
Specialist supplier of SAF units	WPL
PLC/MCC electronic software	Paktronic Engineering Ltd
Turbidity analyser	Hach Lange Ltd
Temporary pumps	Selwood Pumps Ltd

Time on site was greatly reduced due to the modular design and off-site build of the various components. This was reduced further by carrying our factory acceptance tests on the equipment before it arrived on site.

The newly installed SAF units have been shown to comply with EA regulations. A 28 day commissioning sample over the course of January and February 2018 showed a consistently high percentage of ammonia removal; no less than 98% removal throughout the sample period. This analysis was completed from only the final effluent, not the SAF unit nitrate removal. There were consistently low levels of ammonia in the final effluent, reflected in the high percentage removal.

The project was completed in March 2018 over a duration of six months in-keeping with the client's final completion date.

The editor and publishers would like to thank Barhale and the other partners in the IOS Alliance for providing the above article for publication.

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