

# Lampeter STW

Dŵr Cymru Welsh Water carry out critical refurbishments to improve the quality of the final outlet

by Kimberley Hickin

Lampeter Sewage Treatment Works treats sewage from Lampeter, and the surrounding area. The works serves an approximate population of 4,800 and has a combined gravity and pumped inflow rate of 90l/s. The sewage treatment works is located in Lampeter, Ceredigion, in the Mid Teifi Valley, on the borders of Cardiganshire and Carmarthenshire, West Wales. Lampeter is a university town, albeit the smallest university town in the United Kingdom. There is an estimated student population of 1,000 living on campus and within the town and there is one consented trader discharging to the works.



Aerial view of the new FST- Courtesy of Morgan Sindall PLC

## Existing asset

The sewage treatment works consists of the following structures and processes:

- Inlet works.
- Oxidation ditch.
- Final settlement tank.
- Sampling chamber.
- Outfall.
- Return activated sludge system (RAS).
- Surplus activated sludge system (SAS).
- Storm treatment.
- Cold digester tanks.
- Sludge imports.
- Centrifuge sludge storage tank.
- Centrifuge.
- Washwater.
- Odour control plants.

## Reason for the improvements

Investment was needed to address a number of maintenance issues to ensure that the works could consistently maintain compliance and to improve operational efficiency:

- The Inlet screen is not passing forward full flow of 90l/s to treatment (FFT) and is incapable of doing so.
- The FFT Pumps, duty/assist/standby are not delivering their design maximum output of 90l/s with 2 (No.) pumps running.
- Oxidation ditch aeration is poor with target DO levels being difficult to achieve. Aeration capacity of the horizontal rotor is increased by raising ditch water levels but this applies excessive loads on the drive shaft resulting in rotor failure. The rotor is run with minimal immersion by setting the weirs to their lowest setting, 250mm below its highest, resulting in low DO and reduced ditch retention time.
- The oxidation ditch has reduced biological capacity due to low ditch operating levels.
- RAS pump bearings/motor needs replacement.
- RAS is returned downstream of the ditch outlet weir, acknowledging that better performance would be achieved if it were re-routed to the inlet of the ditch.

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- ▶ Micro screens for screening upstream of sensitive processes.
- ▶ Low running costs.



HUBER TECHNOLOGY, Units C and D - Brunel Park,  
Bumpers Farm Industrial Estate, Chippenham Wiltshire SN14 6NQ



Tel: +44 (0)1249 765000 Fax: +44 (0)1249 449076 rotamat@huber.co.uk

[www.huber.co.uk](http://www.huber.co.uk)

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Whitland Engineering  
Unit B, West Street  
Whitland  
Carmarthenshire  
SA34 0AE

Tel: 01994 240 442  
Fax: 01994 240 937  
[info@whitlandengineering.co.uk](mailto:info@whitlandengineering.co.uk)  
[www.whitlandengineering.co.uk](http://www.whitlandengineering.co.uk)





Internal view on the new FST - showing the anti-flotation flap valve positions - Courtesy of Morgan Sindall PLC



External wall of the new FST - showing the outlet position - Courtesy of Morgan Sindall PLC



Internal view on the new FST - Courtesy of Morgan Sindall PLC



Lowering of existing FST outlet pipe - Avoiding a clash with the new sludge draw-off pipe - Courtesy of Morgan Sindall PLC

- The final settlement tank is undersized for both current and future consents resulting in frequent sludge blanket loss.

### Objectives

Principal contractor Morgan Sindall plc and their designer Grontmij were challenged to improve the works to reduce compliance risk and improve operating efficiency. This had to be done whilst taking into account the difficulty and restrictions of achieving an effective solution within an existing treatment works.

The following scope of work was carried forward to design and construction:

- Replace inlet screen with a larger unit that can pass 90l/s FFT.
- Replace underperforming duty/assist/standby inlet pumps to achieve 90l/s FFT.
- Provide additional aeration in the oxidation ditch.
- Clear grit and rag from the ditch without taking the ditch offline.
- Install new duty/assist/standby RAS pumps and flow meter and actuated bellmouth.
- Install new duty/standby SAS pumps and flowmeter.
- Install new centrate pumps and flowmeter.
- Install 17m diameter final settlement tank (FST).
- Install additional outlet chamber and weir at the oxidation ditch to carry forward flows to the new FST.
- Install actuated RAS draw-off system and chamber from new FST.
- Re-route RAS outlet pipework to the ditch inlet.

### Design process

In order to achieve the deliverables within the timescales required, Dŵr Cymru Welsh Water carried out the process design and sized the FST. However, feasibility was not completed prior to the start of detail design. Therefore, design commenced on the basis that obstacles would be tackled as and when they arose. Using the NEC contract, early warnings would be raised as necessary to ensure that the whole team were aware of any potential difficulties. The team could then concentrate on designing or building out any issues associated with the early warnings before they be allowed to develop further.

The project team had a number of significant challenges to overcome in order to implement the project whilst at all times observing compliance with Welsh Water specifications and regulations. These challenges sometimes required agreement to design outside normal standards particularly when interfacing with the existing process. Fitting in new structures within an existing works often means that there is a lack of hydraulic head. This was the main factor for non compliance approvals compared to normal hydraulic design, in addition to obtaining approval to pump outside of the specified ranges.

Lampeter is an operational site and flows through the works had to be maintained. Temporary measures and contingency plans had to be in place for all work being carried out which affect Welsh Water operations; for example replacing screens, pumps and pipework. The timescales permitted for shutdowns in some cases was as little as 4 hours.

The design and construction also had to take account of the fact that there are no standby tanks to enable offline working. All aspects of the work which interfaced with the existing structures required overpumping or alternative methods of flow control to ensure that the treatment process was not interrupted.

One particular difficulty was the additional draw-off from the oxidation ditch. In order to try and achieve equal flow to each FST,

the new weir level had to be set to the same parameters as the existing weir level. Therefore the water level in the tank could only be reduced to the lowest proposed weir setting by fully opening the existing weir to the existing FST. The water level needed to be reduced by an additional metre in height to enable construction of the new weir. Morgan Sindall proposed to complete the construction of the FST first so it could be used to store flows from the oxidation ditch. Morgan Sindall calculated that the new FST, existing storm tank and RAS/SAS tanks provided enough capacity to enable the oxidation ditch to be further lowered for the duration of time needed to complete the connection (approximately one day). The lowering of the water level meant that the surface aerator would not be in contact with the liquor. Welsh Water ensured that a floating Corgin aerator was in place to keep the aeration treatment operational. Once the work is complete, the stored liquor will be re-introduced back into the oxidation ditch via a temporary pump.

Another challenge the team had to overcome was dealing with the inlet flows at the inlet works when installing the new screen and FFT pumps. This work will be carried out in a confined space and since the inlet is prone to flooding on average twice per month, a five day dry weather forecast is required prior to any confined space entry. A temporary screen is to be located on the footpath next to the works so it will be necessary to pump the incoming flows into the inlet of the temporary screen. The outgoing flows from the temporary screen gravitate back into the existing system. The FFT pumps will be replaced when the temporary overpumping system is in place.

#### Significant design decisions

Due to the lack of hydraulic head through the works, the hydraulic design of the new works was based on providing hydraulic similarity between the new and existing works. Where possible, modifications were also made to existing assets to improve safety, security and ease of operation. Additional project scope included automation of the existing RAS to enable equal draw-off from the two tanks and re-routing the RAS return to the inlet of the oxidation ditch.

The major decision, however, was to move away from conventional design and utilise precast concrete wall segments for the FST. Carlow Precast Concrete Engineering was commissioned to carry out the structural design and construction of the basic structure.

This was to shorten construction time on site and minimise labour and plant. The precast units were able to be lowered into place much quicker than fixing formwork and reinforcement. It proved very successful and significantly reduced the construction time and eased the pressure imposed by the confines of the working area.

#### Construction delivery

Preliminary site works began in February 2013, with the site establishment, demarcation and provision of temporary haul roads. To date, the majority of the civil work has been completed and the M&E work has commenced.

The scheme is currently on programme and target to meet Morgan Sindall's 'Perfect Delivery' strategy and the site has received high scores from the external quality supervisors AECOM. Construction is forecast for completion by end of August 2013.

Key participants	
Client	Dŵr Cymru Welsh Water
Principal Contractor	Morgan Sindall plc
Technical Consultant	Grontmij
Mechanical sub-contractor	Whitland Engineering Ltd
Precast concrete FST	Carlow Precast
Mechanical suppliers	Ovivo - Half bridge scraper Corgin - Aerators Seepex - RAS, SAS and centrate pumps Xylem (Flygt Pumps) - FFT pumps Huber - Inlet screen
Electrical suppliers	Technical Control Systems - MCC Pro-Tect - Kiosk

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FST preformed wall unit being lowered into position - Courtesy of Morgan Sindall PLC