

Beckton STW

major upgrade to one of Europe's largest sewage treatment works to create a cleaner, healthier River Thames

by Gary Crisp

Beckton Sewage Treatment Works (STW) in the London borough of Newham is currently one of Europe's largest, treating the waste of 3.5 million people. Thames Water is undertaking a £190m upgrade and expansion of the works to treat sewage to a higher standard and increase the facility's treatment capacity to a population equivalent of 3.9 million. The project forms part of the London Tideway Improvements programme, which is made up of three major engineering schemes to help stop sewer overflows and improve water quality in the River Thames. This programme includes upgrading London's five major sewage works, and construction of the Lee Tunnel and proposed Thames Tunnel, which are designed to prevent pollution entering the Thames from 35 sewer overflow points along the river.



Existing facility and reason for work

Designed to meet the improved environment standards required by the Environment Agency (EA), the project will help to protect the River Thames, the Beckton STW upgrade will enable the facility to handle 60% more sewage during storms and periods of heavy rainfall, and also to allow for a population increase of up to 10% through to 2021.

Concurrently with the upgrade at Beckton STW, Thames Water is developing the Lee Tunnel (featured elsewhere in this publication). This tunnel is designed to prevent discharge from the terminal pumping station at Abbey Mills. When operating with the planned Thames Tunnel in the future, the two tunnels will collectively capture an average of 39 million tonnes of sewage a year, from the 35 (No.) combined sewer overflows (CSOs). When complete, towards the end of 2015, the Lee Tunnel will transfer the additional sewage flows to Beckton STW.

The new works will include high efficiency aeration and pump systems to minimise power usage for wastewater treatment.

The renewable power arising from sludge treatment at this site (wind turbine, solar power, thermal advanced digestion and sludge power generators) will generate a substantial proportion of the energy required and help the site move towards a power self-sufficient wastewater service.

Thames water appointed Tamesis (a joint venture between Laing O'Rourke and Imtech Process) as the main contractor, and work began in June 2010 and is due for completion in March 2014.

Tamesis contract scope

Industry leading innovations have been incorporated into the project, including the extensive use of precast concrete panels (Design for Manufacture and Assembly or DfMA) for the



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construction of tank walls, which has significantly reduced the on-site construction requirements, whilst maintaining quality and increasing site safety and construction reliability. Overall programme and cost advantages have been realised, with a target to achieve safe, high-quality and lean delivery, to complete the project early and within budget.

Tamesis has brought together the complementary in-house skills and experience of its partners, its proven experience of the global supply chain, and specialist design skills of Hyder Consulting, to meet Thames Water's project drivers and quality, programme and financial objectives.

The main scope of the upgrade to the UK's largest STW is to extend the treatment capacity and improve the treated water quality of the sewage treatment works to enable it to treat an increased volume of incoming flow. The majority of the new works has been constructed on disused land to the west of the existing works.

New treatment stream

A new treatment stream is being constructed to operate in parallel with the existing works, providing additional secondary treatment consisting of:

- 2 (No.) activated sludge plants (ASPs), each comprising a plan area of 120m x 90m, 8.5m deep split into 3 (No.) aeration lanes.
- 16 (No.) hopper-bottomed final settlement tanks (FSTs) each of 45m diameter and 3.8m sidewall depth.
- Associated MEICA facilities including pumping stations and a blower house.

The treated water will be transferred from this new stream to the existing final effluent channel via a new 800m long, 3.8m diameter final effluent tunnel and new outfall structure.

Sludge treatment plant

There will also be an upgrade to the existing raw sludge treatment plant, with new treatment facilities including a polymer dosing plant, drum and gravity belt thickeners, sludge storage plant, transfer pumping station and odour control.

A new activated sludge stream is being constructed, with a volume of 135,000m³, in order to treat a settled sewage flow of up to 8m³/s. The activated sludge plant, comprises of 6 (No.) 80m long aeration lanes primarily constructed using DfMA precast units.

These are equipped with anoxic zone mixers, and a high-efficiency fine bubble diffuser aeration (FBDA) system, including 5 (No.) centrifugal blowers with a capacity 29,000m³/hour. Mixed liquor will flow from the new aeration lanes and be equally distributed into 16 (No.) new final settlement tanks, each with a 45m diameter.

Additionally, a major extension has been added to the raw sludge handling plant, where 7 (No.) drum thickeners have been installed to supplement the 4 (No.) existing picket fence thickeners. An increase in capacity of the thickening plant for surplus activated sludge has also been added. The extension to the sludge handling facilities will incorporate all the associated equipment, pipework, ancillary structures and buildings.

Power

The works at Beckton STW also includes improvements to the on-site power distribution system with HV and LV electrical infrastructure, standby power facilities, and to 3 (No.) substations.

In addition, a new substation is required for the new treatment stream, along with 4 (No.) standby generators, each capable of providing 1.6MW of power and a wind turbine capable of providing 2.3MW of renewable power. The project also features a full MCC, ICA, SCADA package, for monitoring and control.



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This improvement project provides a significant step towards improved and sustainable wastewater treatment.

Other activities

The project also includes the provision of roads and hard standings, lighting, new security facilities, drainage, washwater distribution, extension of potable water facilities and welfare facilities in certain new buildings. Provision for ecological enhancements includes creating habitats, landscaping and fencing, as well as soil remediation.

There will also be the refurbishment of 72 (No.) existing final settlement tanks, including improved scraper bridges and new scum removal systems.

Design for Manufacture and Assembly (DfMA)

One of the most important innovations of the scheme at Beckton STW has been the introduction of DfMA. Tamesis is committed to the DfMA principle and it has been adopted for the factory-produced aeration lanes and final settlement tanks walls. This has substantially reduced the number of construction workers required on site, while maintaining quality and increasing site safety and construction reliability. This has contributed to achieving a low AFR of 0.19 to date on the project. The key benefits of DfMA are substantial programme reduction, high quality and safe delivery, cost savings and reduction in on-site labour.

Landscaping and wildlife habitat

Once complete, the scheme will also include enhanced landscaping within the STW. This will include improvements to the Barking Creekside Habitat to encourage wildlife and create a new nature trail. This aspect of the scheme will also involve opening footpaths around the site, creating new paths along the Northern edge of the site by the River Roding and River Thames, to the South of the site.

Suppliers

Tamesis are working closely with key suppliers in order to successfully deliver this project, including:

Xylem Water Solutions (Flygt), Kirk Environmental, JK Fabrications, Gallagher & McKinney, Ashbrook Simon-Hartley, OSIL, Production Glass Fibre, Hawker-Siddeley Power, Crown House Technology, Elsym, BASF, MCS/GPS, FG Wilson, Agreko, HVMS, AVK, Schnieder Electric, Bramley Engineering and DH Stainless.

Programme

Due to the sheer scale of the project it has been broken down into six sections. Three sections have now been successfully completed. Section four, the sludge area, is due for completion in early 2013. The wind turbine, over 100m high and capable of creating 2.3MW of renewable energy, will be erected in 2013, helping to offset the on-site power requirements.

Working together is very important and the Integrated Project Management system, complete with planning and cost controls, has ensured full collaboration between all the stakeholders, enabling the team to drive towards accelerated completion dates.

Overall, the Tamesis team is working closely with Thames Water to ensure continued performance of the existing works and effective management of all interfaces. The use of DfMA has contributed significantly to the project's safe, timely and efficient delivery.

Continued progress and collaborative working will ensure that the project is completed in time and within budget.

The Editor & Publishers would like to thank Gary Crisp, Tamesis Project Director at Beckton STW, for providing the above article for publication.



Sludge digestion substation - Courtesy of Tamesis for Thames Water



FE tunnel - Courtesy of Tamesis for Thames Water



Raw sludge building - Courtesy of Tamesis for Thames Water



ASP4 blowers - Courtesy of Tamesis for Thames Water