Crossness STW

part of Thames Water's London Tideway Improvements programme to create a cleaner, healthier River Thames

by Tim Smith

Thames Water's 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, so they can treat more sewage and to a higher standard. It also incorporates the Lee Tunnel and proposed Thames Tunnel, designed to prevent pollution entering the Thames from 35 sewer overflow points along the river. Thames Water appointed Tamesis, a joint venture between Laing O'Rourke and Imtech, as the principal contractor for the £145 million project to upgrade Crossness STW in east London.

Overview of the Crossness STW site - Courtesy of Tamesis

Existing facility and reason for work

Crossness STW serves approximately two million people in east London. Thames Water's upgrade is designed to meet the improved environment standards required by the Environment Agency (EA), the improvements will enable the site to treat 44 % more sewage than it does now, significantly reducing the amount of storm sewage that overflows into the River Thames during heavy rainfall when the site's treatment capacity is exceeded. This scheme will also allow for a 10% population increase until 2021.

The scheme

At over 70 hectares, Crossness STW is a large and complex site. Many of the schemes complexities are caused not only by the sheer size of the site but also the extensive enhancements to the existing works that are required, while maintaining the current treatment capability at all times. Many of the upgrade activities have required the coordinated shutdown of the whole works and stemming the flows from within the catchment.

The completed scheme will provide improved wastewater treatment with improved resource recovery, and will move the site towards being a more sustainable and power self-sufficient.

The scheme includes:

- The complete refurbishment of the inlet pumping station.
- A new elevated preliminary treatment works.
- A new wastewater treatment stream including primary settlement, aeration lanes and final settlement tanks.
- Additional odour-control for the new and existing plant.
- Sludge storage and thickening equipment.
- Comprehensive power management improvements.
- Refurbishment and upgrading of the existing works.
- Environmental enhancements taking place at Crossness Nature Reserve and the Southern Marshes, including creation of a suitable habitat for water voles and birds.

Renewable energy

Also, the project includes the installation of a wind turbine, which will provide 2.3MW of renewable energy to help offset site power requirements.

When combined with the renewable energy generated from the advanced digestion of sewage sludge, from the thermal hydrolysis plant (THP), which is in the process of being constructed, it will

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generate a considerable amount of the total power required to operate the facility; the equivalent of powering 1,000 homes.

Technical description of design, process and construction work

Work began in late 2009 and the project is now in the commissioning phase. Industry leading innovations have been incorporated, including the extensive use of Design for Manufacture and Assembly, which has ensured a reduction of on-site construction requirements, while 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, early and within budget.

Inlet Works Pumping Station – The work on the inlet pumping station consists of 13 (No.) pumps being replaced online in sequence, while maintaining flow into the existing works. When complete, a third of the existing flow will be split off into the new elevated preliminary treatment works. The upgraded and refurbished inlet works pumping station will be capable of pumping forward a maximum 13.68m^3/second.

The coarse screens at the inlet pumping station are also being upgraded. Thames Water reviewed the alternative screens available, but following review decided that new screens should be reverse engineered in line with the same basic design as the original 1950s screens, to produce a 21st century version of the resilient original.

New Inlet Works: The new inlet works will process 6.5m^3/second and includes 5 (No.) band screens, screenings handling and washer compactors with the maximum capacity of 43m^3/hour of screenings. The inlet works is a spectacular piece of construction and design. Elevated to 12m in height and 100m in length, the structure is a real landmark feature of the project.

Settlement tanks: The screened sewage flow will gravitate to a bank of 8 (No.) primary settlement tanks via twin 1.2km long, 2m diameter culverts. The activated sludge plant comprises of two banks of three lanes – each almost 70m in length with a combined volume of 86,000m^3. Flows then gravitate to 12 (No.) 44m diameter final settlement tanks and from this point the flow is recombined with the existing works flows.

Sludge handling: The new works will create additional sludge which will be treated with additional sludge storage and thickening facilities. There are 5 (No.) raw sludge gravity belt thickeners, each with a capacity of 6,055m^3/day at 2% DS.

Refurbishment and upgrade: In addition to the new works, refurbishment and upgrades are being undertaken to the existing works, including the aeration lanes and final settlement tanks.

Power management: The incoming power supply and power management system has been extensively upgraded. Crossness requires reliable power supply and there is a recognised need to build in substantial resilience, because if power is restricted then the site is liable to flood.

In the event of power shortage, intelligent software SCADA, has been utilised to redirect power to the most important parts of the site, such as the pumping station, which must be protected to minimise flooding risk. Two additional standby generators on site can each provide 2MW of power.

Undertakings

Principal contractor Tamesis, a joint venture between Laing O'Rourke and Imtech, 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.

Overview of the Crossness STW site - Courtesy of Tamesis

The 12 (No.) final settlement tanks - Courtesy of Tamesis

View of the preliminary treatment works in the distance with the public road to the left and housing in the top of the photograph Courtesy of Tamesis

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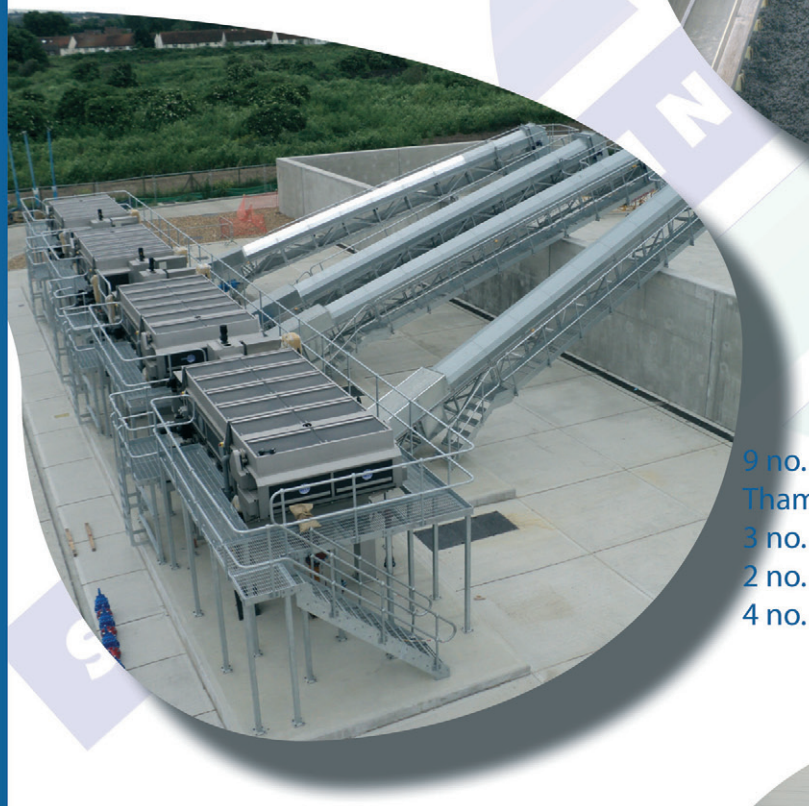

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2 no. U520 in Bracknell STW for B&V
4 no. U520 in Beddington STW for GBM

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The challenges and innovations

With a scheme of this scale the team was faced with a number of challenges on site. One of the most important was maintaining the performance of the existing process while constructing the new plant. The construction team has more than 300 operatives and 60 management and engineering staff based on site. These in-house resources enable the multiple complex interactions with existing operational assets and systems to be safely planned and managed.

Other challenges have included mitigating the environmental impact of the construction work. To offset for habitat lost by construction, the project team has created a new reed bed, and wader scrape, and dug two new ditches to encourage local wildlife species.

During the design development the team optimised the process solution, improving the new works operational efficiency and reliability, including the installation of a 2.3MW wind turbine to generate up to 20% of the site's energy demand.

Other challenges have included taking on board the local planning issues and minimising the traffic logistics, mitigating against odour nuisance and ensuring that the environmental enhancements of the project were promoted to the local community.

Design for Manufacture and Assembly

One of the most important innovations of the scheme at Crossness STW has been the introduction of Design for Manufacture and Assembly (DfMA). Tamesis is committed to the DfMA principle and it has been adopted for the factory-produced elevated inlet works sections, final settlement tank walls, primary treatment and aeration basins. This has reduced the number of site workers required on site, while maintaining quality and increasing site safety and construction reliability. This has contributed to achieving a zero AFR to date on the project.

DfMA enables precasting of many elements off site. This in turn minimises construction activity on site; improving safety by reducing working at height requirements and general construction interfaces because the construction activity is carried out in a controlled, purpose-built factory environment. This also reduces the environmental impact of the construction work, including minimising construction traffic.

DfMA has also been used for the inlet pumping station MCC building, which includes brick cladding assembled off site.

Key suppliers

In order to deliver the Crossness STW upgrade, Tamesis is working closely with many suppliers, including:

Xylem Water Solutions (Flygt), Kirk Environmental, FSD, Imtech G and H, JK Fabrications, Gallagher & McKinney, Hydro International, Ashbrook Simon Hartley, Bord Na Mona, Production Glass Fibre, Hibernia, Bedford Pumps, AJ Fabtech, Elsym, BASF, Longwood Engineering, AVK, Regulators Europa, Broadcrown, Lintott, Brush, Serpecon, Schnieder Electric, Thetford International, Bramley Engineering and DH Stainless..

Programme

The project is currently in the commissioning stage with a phased programme of bringing all of the new plant on line whilst maintaining existing works performance.

The Editor & Publishers would like to thank Tim Smith, Project Leader with Tamesis, for providing the above article for publication.

The author wishes to thank Thames Water for its support, as well as all the companies and their employees who have contributed to the successful delivery of this project to date.

Preliminary treatment works with the new Blower House (brown roof) - Courtesy of Tamesis