

# Crossness & Beckton STW Schemes

upgrades complete; helping to make the Thames a cleaner, healthier river

by Neil Cuthbert & Tim Smith

Thames Water has invested £220m at Crossness STW and £190m at Beckton STW to help stop sewer overflows and improve water quality in the River Thames. The two projects were part of Thames Water's London Tideway Improvements programme. Crossness STW serves approximately two million people and the scheme is designed to meet the higher environment standards required by the Environment Agency (EA), and the improvements enable the site to treat 44% more sewage. Beckton STW was already one of Europe's largest works and the expansion now enables the site to treat the waste of 3.9 million people, up from its former population capacity of 3.5 million. The upgrade enables the works to handle 60% more sewage during storms and has been designed to treat increased flows from the terminal pumping station at Abbey Mills, additional storm flows from the Lee Tunnel, plus flows from the future Thames Tideway Tunnel. Both schemes allow for a population increase of up to 10% through to 2021.



Beckton STW ASP 4A aeration tanks - Courtesy of Thames Water

## Crossness STW

The Crossness STW lies on 70 hectares. The upgrade project began in November 2009 and included the complete refurbishment of the inlet pumping station, construction of a new elevated preliminary treatment works, and a new wastewater treatment stream – including primary settlement, aeration lanes and final settlement tanks. Additional works include sludge storage and thickening equipment, and extensive refurbishment and upgrading of the existing works, along with comprehensive power management improvements. Also, the project included the installation of a wind turbine, which provides 2.3MW of renewable energy.

Industry-leading innovations have been incorporated into the project, including the extensive use of Design for Manufacture and Assembly (DfMA), which has ensured a reduction of on-site construction requirements, while maintaining quality and increasing site safety and construction reliability.

## Design for Manufacture and Assembly (DfMA)

Tamesis is the principal contractor for both the projects. Tamesis is committed to the DfMA principle and it has been adopted at both Beckton and Crossness for the factory-produced elevated inlet works sections, final settlement tank walls, primary treatment





# Fields of **Dominance...**

**WEHOLITE**

**ASSET**  
International Ltd.

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

and aeration basins. This has reduced the number of site workers required on site, while maintaining quality and increasing site safety and construction reliability. It has contributed to achieving a zero AFR to date on the Crossness project.

DfMA enables precasting of many elements off site. This in turn minimises construction activity onsite, 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.

Overall programme and cost advantages have been realised, with a target to achieve safe, high-quality and lean delivery, 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 upgrade at Crossness also provides additional odour control, for elements of the new and existing plant and environmental enhancements taking place at Crossness Nature Reserve and the Southern Marshes – including the creation of a suitable habitat for water voles and birds.

The work on the inlet pumping station consisted of 13 (No.) pumps being replaced online in sequence, while maintaining flow into the existing works. The upgraded and refurbished inlet works pumping station is now able to pump forward a maximum 13.68m<sup>3</sup>/second.

The coarse screens at the inlet pumping station were also upgraded. In addition to the new works, there was a refurbishment and upgrade carried out to the existing works, including the existing aeration lanes and final settlement tanks. The scheme also included an extensive upgrade to the incoming power supply and power management system.

The whole site has been upgraded to an 11kV network with a new 33kV incomer, new generators and substation installed by the team. In addition the whole works has been upgraded with new control and SCADA alongside an extended power management system.

Work began at Beckton in June 2010. As at Crossness STW, industry-leading innovations were incorporated into the project, including the extensive use of precast concrete panels for construction of the final settlement tanks and aeration tank walls. At Beckton STW, Tamesis has increased the size of the works through additional aeration lanes, final settlement tanks, sludge treatment and odour control.

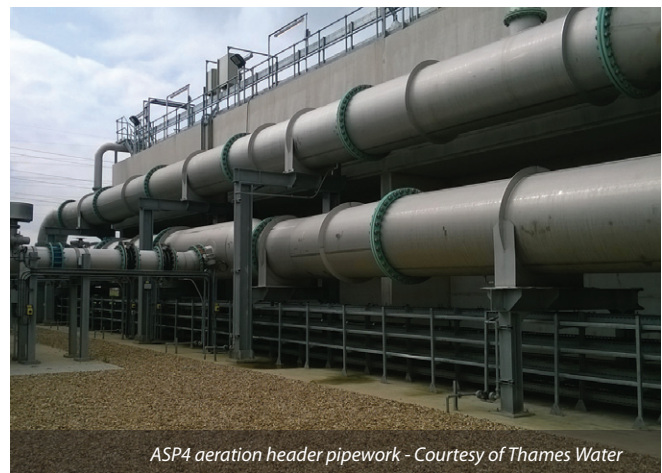
To facilitate the increased treatment capacity, the upgrade project delivered a new activated sludge process stream, which has been built alongside the existing plants. The new stream processes 30% of the total works incoming flow and comprises 6 (No.) aeration lanes, arranged in two streams of three, with each lane having a total volume of 22,500m<sup>3</sup>.

To deliver process flows to the aeration tanks, two settled sewage/return activated sludge pumping stations have been constructed, containing a total of 8 (No.) pumps (four per pumping station) which weigh a combined 80 tonnes and are each capable of delivering 3,000l/s.

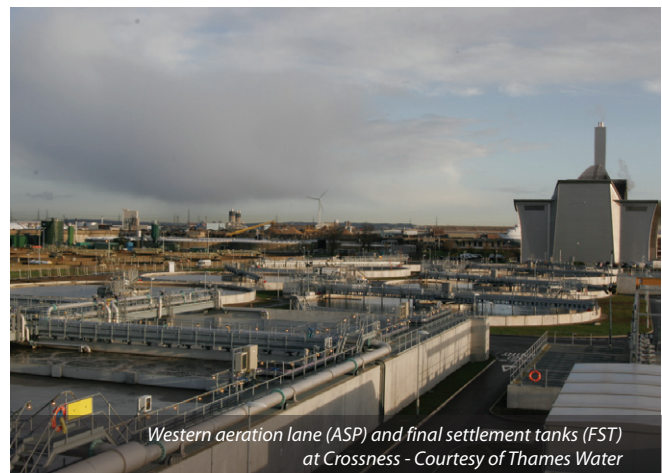
Downstream from the aeration tanks, 16 (No.) precast FSTs have been constructed containing 45m full bridge scrapers, the largest of their type in the UK. Final effluent from the new ASP4 plant passes through a new 700m long, 3m diameter tunnel before discharging into the existing works outfall channel and into the River Thames.



Beckton STW: ASP4A settled sewage - RAS pumping station  
Courtesy of Thames Water



ASP4 aeration header pipework - Courtesy of Thames Water



Western aeration lane (ASP) and final settlement tanks (FST)  
at Crossness - Courtesy of Thames Water



Blower MCC, ASP lane and FSTs at Crossness  
Courtesy of Thames Water





# LYALL BILLS & YOUNG

**Award-winning Architects**  
for water, sewage and other  
infrastructure projects

www.lbyarchitects.com tel. 020-7253-1630



World leading double membrane gas holder provider with design, detailing and manufacture carried out in the UK.

**BIODOME®** double membrane gas holder:

- Utilises the highest strength membranes available in the global market
- Designed for a wide range of working gas pressures, storage volumes and gas production rates
- Can accommodate the requirements of any sewerage, wastewater treatment, industrial effluent or biogas plant
- Can be supplied as an independent free-standing unit or mounted to the top of a steel or concrete tank

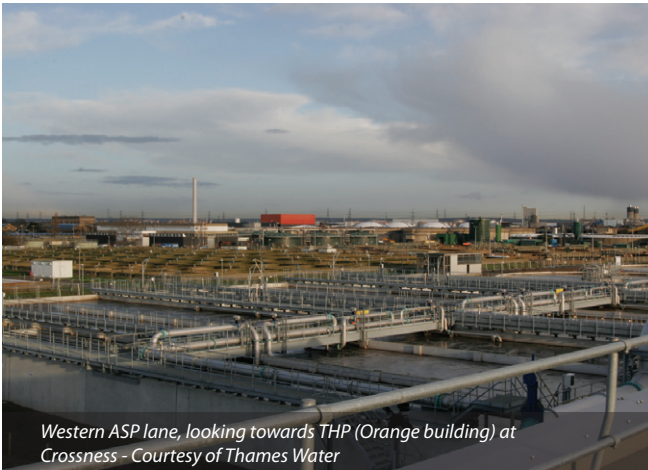
[www.biodome-international.com](http://www.biodome-international.com)



T : +44 (0) 1282 677966  
E: [enquiries@biodome-international.com](mailto:enquiries@biodome-international.com)  
[www.biodome-international.com](http://www.biodome-international.com)







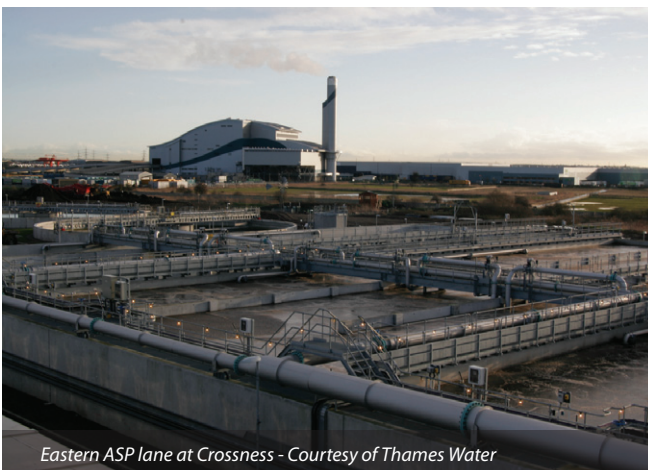
Western ASP lane, looking towards THP (Orange building) at Crossness - Courtesy of Thames Water



Eastern ASP lane at Crossness - Courtesy of Thames Water



Primary settlement tanks (PST) at Crossness - Courtesy of Thames Water



Eastern ASP lane at Crossness - Courtesy of Thames Water

The site's existing 6.6kV sludge ring has been replaced in its entirety and the primary sedimentation tank substation, south west substation and sludge digestion substation have been fully refurbished, including the replacement of high-voltage switchgear, transformers and associated power management control systems.

In order to ensure power resilience on site new diesel generators have been installed; in addition a 2.3MW wind turbine has been provided as a source of renewable energy.

#### Computational Fluid Dynamics (CFD)

As part of both STW schemes, MMI Engineering provided modelling assistance to Thames Water, with the design of the new final settlement tanks. The limits of performance were assessed using Computational Fluid Dynamics (CFD), modelling the hindered settling behaviour within the FSTs and revealing operating values for ESS and sludge bed height, in typical process conditions.

The counter flow energy dissipating influent design for the Crossness tanks was also tailored using CFD modelling in conjunction with A&J Fabtech (Water). CFD models of the Crossness FSTs were run with transient inputs, to determine the tanks' response to severe storm conditions, where rapid increases and then decreases in treatment flow occur.

Even under the most extreme of conditions, the tanks performed well, with only short periods where the settled sludge blanket became unstable and desired ESS limits were exceeded.

CFD modelling provided by MMI Engineering also provided guidance on design options for modifications to the fine screen chamber at Crossness STW, during the site upgrade. Design options were tested to determine the most desirable flow pattern and solid settlement characteristics within the chamber, without the need for costly alterations after construction.

#### Key suppliers

Thames Water appointed Tamesis, a joint venture between Laing O'Rourke and Imtech, as the principal contractor to carry out the two prestigious projects in east London. To deliver these schemes Tamesis has worked closely with many suppliers, including:

*Xylem/ITT Flygt, Ovivo, Kirk Environmental, FSD, Imtech Engineering Services Central, JK Fabrications, Gallagher & McKinney, Access Design & Engineering, Hydro International, Alfa Laval Ashbrook Simon Hartley, Bord Na Mona, Odour Services International, Production Glass Fibre, Hibernia, Bedford Pumps, AJ Fabtech, Elsym, BASF, Longwood Engineering, AVK, Invicta Valves, Regulators Europa, Broadcrown, GPS/MCS, Lintott, Brush, Serpecon, Schnieder, Hawker Siddley, Igranic, Power Electrics, Thetford (Skip Loaders), Bramley Engineering, Lowestoft Offshore Services, Secure Engineering, Crownhouse Technologies Ltd, Industrial Penstocks, Pettit Construction, Air Technology Systems, Z-Tech, TEW and DH Stainless.*

#### Compliance

At Crossness, compliance was achieved at the end of March 2014 and the wind turbines were handed over and taken into operation in March, with a full handover this summer. The scheme at Beckton has reached compliance in January 2014 and sectional handover has now been achieved.

*The Editor & Publishers would like to thank Neil Cuthbert, MEICA Project Leader with Tamesis, and Tim Smith, Operations Manager with Imtech, for providing the above article for publication.*

*The authors wish 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.*



INTRODUCING THE GLOBAL LEADER IN COVER SOLUTIONS.

# CST COVERS



**TEMCOR**

**CONSERVATEK**

**SINCE 1964 • OVER 16,000 INSTALLED • OVER 90 COUNTRIES**

**Aluminum Domes & Flat Cover Solutions for ALL Water and Wastewater Applications**

- Long Lasting
- Maintenance Free
- Environmentally Friendly
- Corrosion Resistant
- Formed & Extruded Flat Covers
- Superior Odour Control
- Easily Removable Panels

**Represented in the UK by:**

John Stanley  
Office: ++44 (0) 1472 506122  
Mobile: ++44 (0) 7739 037294  
nastonltd@yahoo.co.uk

**[www.cstcovers.com](http://www.cstcovers.com)**

CST Covers | 498 N Loop 336 E | Conroe, TX 77301 USA | p: 936-539-1747 | f: 936-539-5355