

# Wigan WwTW quality (Q) scheme

by  
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**W**igan Wastewater Treatment Works (WwTW) is located near Ormskirk, Lancashire. It treats trade and crude effluent from a population equivalent of 350,000 with a consented Flow to Full Treatment of 167 megalitres/day; it has a storm water storage capacity of 65,000m<sup>3</sup> for bathing water compliance. The works currently discharges secondary treated effluent into the River Douglas to a bathing water standard which complies with a 30:45:10 mg/l (BOD: SS: Ammonia) consent.



3D image of BAFF - Pumping Station; Distribution Chamber and BAFF Cells

Courtesy of IA+

At the commencement of AMP4 a strategic joint venture partnership of GallifordTry, Costain and Atkins (GCA JV) were successfully awarded a £470m, 5 year contract, as Process Partner, to deliver new and refurbished water and wastewater treatment projects throughout United Utilities southern area within an Integrated Alliance known as IA+. The alliance is a blend of multidisciplinary professionals from within the client, solution services provider and process partner, operating as one co-located integrated team in an end to end partnership to deliver high quality assets safely, within schedule and budget. The IA+ vision was clear - for all parties to work collaboratively together to deliver the capital investment programme as effectively and efficiently as possible.

Under the AMP4 programme, United Utilities have invested circa £50m on improvements at Wigan WwTW, including four other strategic projects which were also carried out in parallel with the Quality project at Wigan:-

- Inlet Works - New Inlet Pumping Station, Coarse & Fine Screens and Grit Removal
- UID project - Additional 65,000m<sup>3</sup> volume of stormwater storage
- Power Supply - Electrical power supply upgrade
- Bridges Project - New primary settlement tank scraper bridges, storm tank cleaning facility and remedial works to existing sludge tanks

With a revised 3mg/l Ammonia standard being imposed on the works in March 2010, the IA+ identified an alternative tertiary treatment

process; Biological Aerated Flooded Filter (BAFF) plant, in lieu of the Financial Determination (FD) Solution; Nitrifying Trickling Filters (NTF's) and a Rapid Gravity Filter (RGF). This alternative treatment process was proposed to ensure the lowest whole life cost option was derived and project risk was minimised by a reduced footprint and the BAFF structure being designed at ground level.

The compact nature of the BAFF processes allows for the biodegradation of all carbonaceous and nitrogenous pollution together with clarification of the effluent by filtration through the highly buoyant polystyrene media bed. Process air is introduced at the base of each unit when required; which enables the media bed to sustain the ideal environment for biological activity.

Time was a critical factor, which drove an unorthodox approach to the normal processes and procedures for procurement, design and construction to ensure success. IA+ adopted a competitive tender procurement strategy for the process design of the BAFF plant early in the project life cycle, to enable the solution services provider and process teams to work hand in hand on an integrated design and construction schedule.

Under the Main Contract Veolia Water Solutions & Technologies (VWS) were awarded the Process design package for the BAFF plant comprising 10 no. 84m<sup>2</sup> filter cells in July 2007. As nominated sub-contractor, their scope of supply included for the provision of all associated plant and equipment within the boundaries of the BAFF structure including the process design, site supervision of the M&E and EICA installations, software and commissioning of the plant.

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Following the appointment of the process contractor, the process design rapidly progressed. IA+ Process Engineers liaised closely with VWS to provide an optimized process solution and BAFF cell configuration.

They liaised closely with GCA and the solution service provider MWH, to finalise the project requirements with respect to plant layout Mechanical, Electrical and Civil requirements. Provided input into hydraulic plant and equipment loadings, which enabled the Solution Scope Book to be completed and issued to GCA to commence detail design in September 2007.

To ensure the compliance date was not jeopardized a fully integrated approach was adopted to fast-track this project and aid its successful delivery. This enabled seamless working of multidisciplinary teams and early engagement of specialist sub-contractors and suppliers as necessary. Civil guidance details were provided to enable early commencement of Civil General Arrangement drawings and structural designs. Hydraulic engineers worked closely with VWS to establish and fix the optimum hydraulic gradient for the plant, prior to commencing site operations. The risks of this design approach were actively managed by the integrated team throughout the life cycle, whilst the detailed design and site preparation works were being developed and progressed in parallel with production of the solutions scope book.

### BAFF Solution

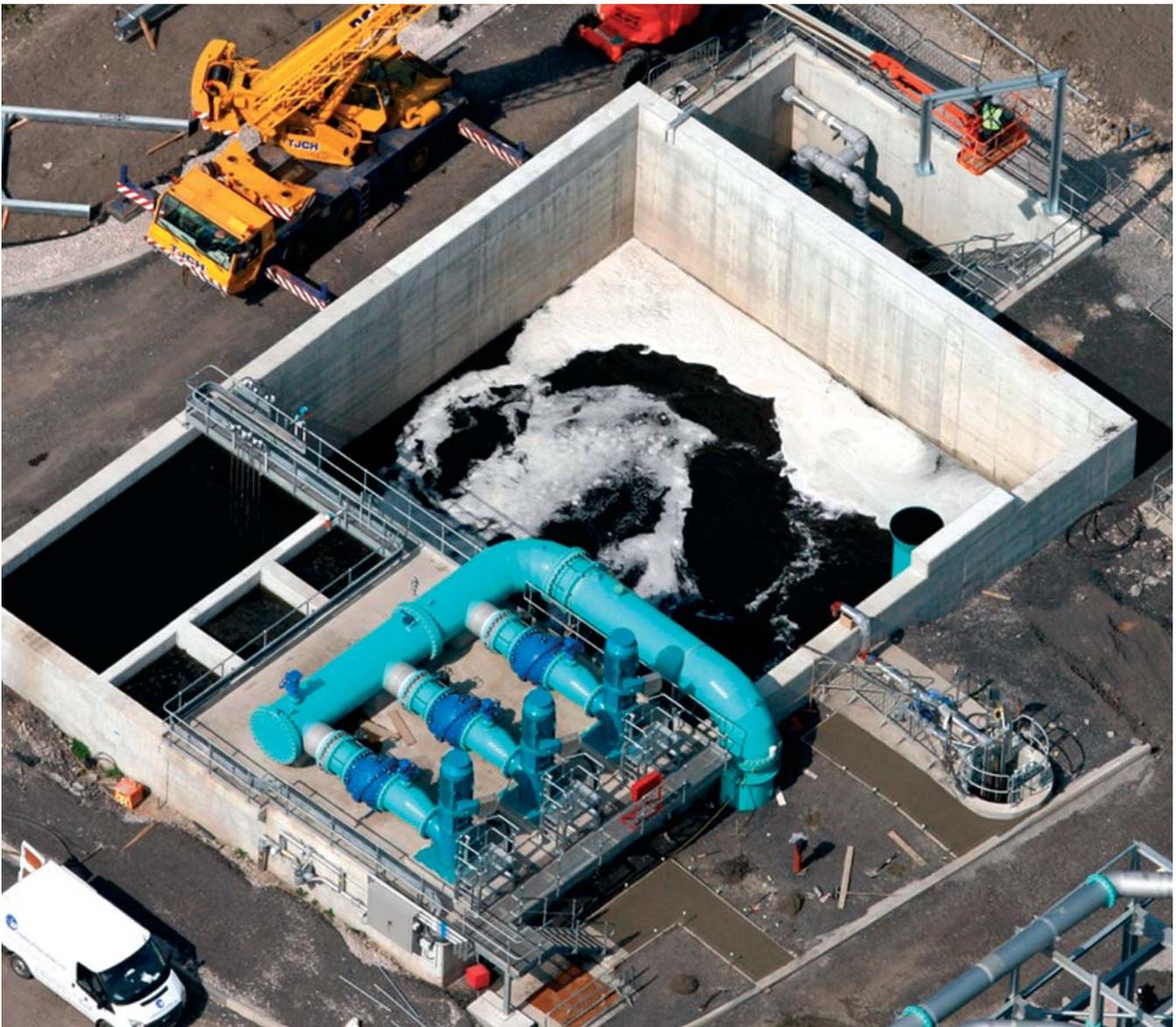
The BAFF at Wigan has been located at ground level providing free access to the technical gallery process air blowers for ease of operation and maintenance. To optimise the construction schedule, where possible concrete channels have been replaced with fabricated pipework.

The main scope elements of the BAFF solution comprised:-

- BAFF Feed Pumping Station including feed chambers and mixed flow floating bowl pumps - 16m x 8.25m x 5.9m
- Elevated BAFF Distribution Chamber - 8.3m x 5.7m x 10.2m
- 10 No 84m<sup>2</sup> Cell BAFF Plant - overall footprint 68.825m x 14.810m, individual cell 6.1m x 13.81m x 7.335m
- Externally mounted 90kw Blowers
- Backwash Tank (700m<sup>3</sup>) including Dirty Backwash Return pumps and mixers - 16m x 15.8m x 5.9m
- Dirty Backwash Return pipeline - 660m of 250 OD PE
- Modifications to Existing Chambers
- MCC Control Kiosk
- Provision of New Power Supply including HV, transformer and MCC

### Design innovation

To aid understanding of the project with respect to plant layout and



Construction Photograph of BAFF PS and Dirty Backwash Tank

Courtesy of IA+



Construction progress March 2009 - pumping station (back left) - MCC Kiosk (front left) BAFF Plant and Distribution Chamber (right)

Courtesy of IA+

process configuration, a series of 3D fly-through models and images of the BAFF plant and site layout were produced. These 3D images proved invaluable to the construction team and Operations enabling them to gain a full appreciation of the project solution and its complexities from a construction and health and safety perspective. These images increased operator confidence in the project solution by demonstrating that important access and operability issues were being adequately considered, through the integrated design approach and engineered into the final project solution. The models and fly through images were later used in the design process to help ease the project through both Hazard and Operability (HAZOPS) and Access Lifting and Maintenance (ALM) Reviews.

During development of detail design, the team enhanced and refined the project by the application of innovative ideas and solutions to further improve constructability of the plant to maximize Value Engineering (VE) opportunity. These refinements resulted in schedule advantages and commercial savings. Some of these savings were realised through:-

- Relocation of the Dirty Backwash Tank to improve construction access
- Revised BAFF pipe gallery drainage which removed the need for a deep sump pump chamber
- Use of pullout bars and wall couplings to facilitate uninterrupted wall pours
- Relocation of the Air Release Chamber to suit constructability, commissioning and operational issues

Further savings were also achieved on construction of the BAFF feed pump station/dirty backwash tank by eliminating the requirement for piling, dewatering and other temporary works, by stabilising the formation using granulated lime. 3D design technology was also

used to optimise cut and fill volumes, to ensure the most cost effective and sustainable solution was achieved.

The BAFF plant at Wigan incorporates the VWS Regulfiltre® and Dissolved Oxygen (DO) optimisation software, which is installed on all new Biostyr® plants as standard.

#### Summary

The successes to date on this project are attributable to the fully integrated approach, early involvement of key suppliers and sub Contractors and collaborative working of "seamless" multidisciplinary teams. Early construction and process input together with phased release of key information, has enabled project risk to be to be effectively managed and the overall delivery schedule durations minimized.

The challenge of the FD Solution and the provision of an innovative alternative has been instrumental in ensuring the best value solution was determined to satisfy the Need of the project.

Through a well engineered compact design, a robust alternative solution has been provided in the shortest possible time at lowest whole life cost, with the added security and benefit of a proven technology which is flexible enough to suit either filtration mode Operations choose to run the plant in.

Progress to date - Civil construction, mechanical and electrical installations are now complete with commissioning of the BAFF due to commence in the near future. Project in use is currently forecast towards the end of year, ahead of the Regulatory date in March 2010.

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