Warrington North WwTW improvements

£4 million enhancement to ensure effluent compliance

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Warrington WwTW had four existing final tanks that were not providing the necessary settlement volumes for flow to full treatment and the works were at risk of not meeting consent requirements. Approval was given to construct two additional final tanks to improve the process criteria and ensure EA compliance. A fast track contract was awarded by United Utilities in December '02 with project completion required by September 2003.

Warrington North WwTW: 35m Rim Flo clarifier – commissioning phase *courtesy: Galliford Costain JV*

Innovative design

Innovative treatment process design for the AMP2 secondary treatment works schemes was promoted by the use of *Envirex* equipment, a United Utilities company at the time. Three major secondary treatment plants incorporating this innovative technology were constructed throughout the North West of England during the AMP2 programme. *Envirex* technology dictated the process unit requirements which consisted of the *Orbal* basins, an activated sludge system, together with the flat bottomed Rim Flo clarifiers/final tanks and their associated unique desludging system.

The existing wastewater treatment works treats a flow to full treatment of 143,000M^{3}d; primary and secondary process units consist of low and high level inlet screw pumping stations, 6mm elevated inlet screens and "bendy channel" grit removal, eight circular primary tanks with auto desludging, stormwater storage, selector tank, two Orbal aeration activated sludge tanks, RAS/SAS pumping station, four Rim Flo final clarifiers with associated flow distribution chamber. Final effluent discharges by gravity to the River Mersey. The proposed new Rim Flo clarifiers were to be replicas of the original design as provided by *Bechtel Water Teehnology* under the AMP2 programme.

Scheme proposals

The £4.0m scheme for the construction of the two additional final tanks and associated distribution chamber/pipework extensions was identified by *MWH* in conjunction with United Utilities operations to ensure effluent compliance with current EA consent standards.*Galliford Costain JV*, United Utilities Southern Area Framework contractor in association with *Atkins Water* as Civil, Mechanical and Electrical designers undertook the detailed design and construction which consisted of the following main elements:-

* two 35.0m dia. x 5.0m deep flat bottom Rim Flo Clarifiers;
* 700Kn rock anchor anti flotation system to tank base;
* new 600mm, 900mm & 1000mm dia interconnecting process pipework and associated hydraulic connection chambers;
* additional 3.0m long distribution weirs to existing operational flow distribution chamber;
* stainless steel central pier, sludge header, rotating bridge and scum collection equipment as provided by *Vivendi Water (USA);*
* electrical & ICA;
* site works;
* roads & hard standing.

Warrington Rim Flo clarifier tow bro arm used for final screeding of base slab

Technical description

Mixed primary effluent enters the outer lane of the Orbal basin via the selector tank where it is circulated using the unique *Envirex* surface aeration system around the Orbal lane. Effluent gradually works is way to the inner lanes of the Orbal basin through a series of openings and penstocks,where it is drawn off by the centre island and discharges by gravity to the distribution chamber.

Flow is then split equally to the four Rim-Flo clarifiers for final settlement prior to discharge to the River Mersey.

United Utilities required the additional tanks to be based on the same construction parameters as the previous design. The Rim-Flo clarifiers are not your conventional sloping floor, hopper bottomed type final tank. The *Vivendi* design required a flat bottomed tank with a central sludge draw off via a rotating *Tow-Bro* desludging arm. Desludging was carried out using the hydraulic head from the tank via the horizontal *Tow-Bro* arm. The large flat bottomed structures, 35m diameter x 5.0m deep, were to be constructed adjacent to the existing operation tanks in ground of exceptionally high water table. This had major design and construction implications, for both temporary and permanent work design.

Advanced award released *Atkins* design teams, who set to work with immediate effect. Structural record drawings and design calculations were not available for the Rim-Flow clarifiers so *Atkins* structural engineers set to work producing a finite element (F.E) design of the large structure which incorporated the interaction of the 700Kn anti flotation, rock anchor system. *Atkins Structural* and geotechnical engineers worked closely with MWH structural department to resolve design issues and develop an agreed design solution. The quick resolution of the structural design released *Atkins* engineers and RC detailers in the development of the engineering layouts and detail construction drawings which were required almost immediately to meet construction deadlines.

Atkins mechanical engineers in association with *COGAP* liaised with *Vivendi Water (USA)* for the design and procurement of the specialised Tow-Bro hydraulic desludging system. It was decided, with the agreement of United Utilities and *MWH* to construct the rotating bridge and desludging arm from stainless steel. This would give the required design life without the application of final paint work and would speed up installation. Mechanical engineers resolved design issues swiftly as the manufacture and shipping of the bridges to the UK were on the critical path. Electrical design and procurement progressed in parallel interfacing with the existing operational plant.

Team working was paramount for the successful delivery of this project due to the tight site programme deadlines and operational interfaces. The construction team worked tirelessly to programme the construction sequencing and operational interfaces required and identified that both tanks need to be constructed in parallel to achieve the target dates. Problem free and efficient installation of the dewatering system and circular sheet pile cofferdams was critical to achieving the construction programme. A steel shutter system was proposed for the tank wall construction, interchanging between tanks to get the most cost effective construction.Large diameter process pipework needed to be connected to existing chambers and stub pipework left by the previous contract.

Pipework excavation proved difficult adjacent to the existing operational structures, encountering high ground water and connection to the existing flow distribution chamber required extensive cooperation between *GCJV and UU* operations to ensure process flows were maintained while making the final connections to the live chamber. *Atkins* design engineers worked closely with the construction team to review buildability and provide geotechnical advice and on site support for the proposed dewatering and rock anchor system required by the design.

Conclusion

Atkins Water multidisciplinary design teams were co-located with *Galliford-Costain,* which included estimators, quantity surveyors and construction staff. The close proximity to the various members of the design delivery team allowed a design approach which minimised construction cost and/or time, promoted ease of construction ensuring a fast track delivery programme. Innovation in the design was actively encouraged which resulted in a reduction of capital cost and improved the maintenance, operability and safety aspects of the scheme.

The programme was very tight and the design and construction team pulled out all the stops to ensure project delivery. The project was successfully designed, constructed and commissioned within a 9 month period and was delivered under budget and in advance of its required completion date to the great satisfaction of *United Utilities* management team. ■

Note: *The author of this article, Martin Meadows, is Principal Civil Engineer, Atkins Water.*