Wigan WwTW

Amp3 improvements have two objectives

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Two objectives were set for improvements at Wigan WwTW as part of United Utilities AMP3 settlement. The first objective required the reduction of storm discharges to an average of three spills per Bathing Season, The second objective required the delivery of a Treatment Improvement Project to increase the flow to full treatment to meet a modern (3PG+3E+I) flow calculation, as well as a new consent standard. The new requirements were to improve the effluent from a 30/70/10 (BOD/SS/NH4) 95 %ile to a 30/45/10, and provide UV treatment to achieve a received dose of 35 mJ/cm$^{2.}$

Storm tank with one side under test *(courtesy Montgomery Watson Harza)*

The required completion date for the Storm Management Project was 31st March 2001 and for the Treatment Improvements Project was 30th September 2002.

Programme

Montgomery Watson Harza was appointed as Engineering Service Provider (ESP) to United Utilities (UU) at the start of AMP3, in April 2000. The storm management element of the Wigan project was required to be in use by the start of the following Bathing Season, leaving just 12 months to complete. This meant a major driver on the project was time, which influenced both the design and procurement strategies.

The 'Big Picture' solution

With regard to reducing the number of storm spills per Bathing Season, a balance needed to be struck between increasing the flow through the WwTW and providing additional stormwater storage. This was influenced by tightening of the WwTW consent – any increased flow to full treatment (FtFT) would also have to be treated to a higher standard. Another factor was the ability to return stormwater through the WwTW after incoming flow receded – if the FtFT were too low, the storm tanks may not empty before the next storm arrived. The practicalities of increasing FtFT were also an issue, the capacity of the existing plant and the presence of an inter-stage pumping station had to be taken into account.

A range of options between providing zero and the maximum additional storm storage were reviewed. The most economic, based on whole life costs, was to increase FiFT to the modern calculation figure of 167 Ml/d from the actual 123 Ml/d, and provide an additional 24,000 m^3 storm storage. This storage was to be in the form of tanks on the WwTW site.

Detailed design issues – storm storage

Next major question for the storm storage provision was whether it was to be above or below ground. There were some existing storm tanks at Wigan, which were above ground and fed by the inlet pumping station. This pumping station lifted all the flow arriving at the WwTW and the maximum total flow of 408 Ml/d would remain constant Thus, above ground tanks could be fed by the existing inlet pumps and gravitate back to the inlet, removing the need for an additional pumping station. The water table was also high, making below ground construction a costly exercise. The drawback for a gravity return system was the need to integrate with the existing inlet works arrangement and maintain its operation during construction. Without a pumped storm return the hydraulic design of the new system was also more complicated. However, the cost savings, both capital and operational, were considered to outweigh the risks and an above ground tank was selected.

Cost saving innovations

* **combining the feed and emptying pipework for the new tank** – the tank was never going to fill and empty at the same time, and the inlet pumping station generated sufficient head, so it was possible to have a single pipework system;
* **splitting the tank into 2 sections** – the tank would be fitted with sparge pump mixers to re-suspend settled solids. The majority of storms should only fill the first section – reducing the area of tank floor required to be cleaned;
* **utilising existing assets** – the existing storm tanks were to be retained. The philosophy being to fill the new tanks (which would be blind) first and then divert flow to the existing tanks. This enabled retention of the existing storm overflow and discharge structures and pipework.

Detailed design issues -WwTW effluent quality improvements

Biological treatment at Wigan was provided by trickling filters, operating in an Alternating Double Filtration (ADF) system. Works data showed this to be particularly efficient, with the filters out performing their theoretical capacity. Several options were considered for improving the overall works performance to meet the new consent, including: switching the filters to single pass, providing more filter volume and introducing an additional biological stage downstream.

The chosen solution was to retain the existing filters in ADF operation and add additional humus tank volume. It was acknowledged that this was the most difficult option to construct, due to the need to, once again, integrate the existing plant whilst maintaining treatment.

Further cost saving innovations

* **retention of efficient biological filter system**
* **dedicated new inter-stage pumping station** – the existing combined inter-stage screw pumping station was retained as a dedicated second pass station, with a new first pass station constructed alongside. This allowed offline construction and avoided mixing new and old technology, which gave greater flexibility in selecting the type of new pumps used. The alternative would have been to extend the existing screw pumping station.
* **Common sizing of the new humus tanks** – the theoretical sizes of the new first and second pass tanks were different. A decision was made to over size the first pass tank to allow a common size and, therefore, generate a cost saving by standardising on equipment and temporary works for construction.

Humus tank under construction *(courtesy Montgomery Watson Harza)*

Procurement

The procurement strategy was determined by the various consent dates applying to Wigan. Reducing the number of storm discharges was the most pressing requirement and this was initially developed as a separate project to the water quality improvement measures.

Following the two projects' Optioneering phases, it became apparent that there would be commercial advantage in letting both the storm storage and WwTW improvements schemes as one contract. This was due to the solutions for each including large elements of reinforced concrete construction and pipe laying. The one area of the overall scheme not progressed sufficiently was the provision of UV disinfection, As a specialist area and with a consent date of September 2002, this item was left as a stand alone project.

To maximise the chance of achieving the 31st March deadline, measures were taken to utilise all the available time:

* *Cheetham Hill Construction* undertook an advanced works contract to prepare the ground for the new storm tank and deal with any unforeseen obstructions. As a smaller contract, this was able to be brought to site quickly and saved approximately 6 weeks on the main contract programme;
* The main contract included some design work for the Contractor. However, key elements (such as the storm tank and humus tanks) were designed in house, with details included in the tender. This gave the contractor the ability to start construction immediately after the contract award and avoided losing time on site whilst detail design progressed.

Construction

A £3.1m contract was awarded to *Pierse Contracting* for construction of new storm tanks, inter-stage pumping station and humus tanks, with all associated pipework and controls.

Key obstacle to achieving the programme was working around the operational plant. This was overcome by developing good teamwork between the contractor, the client's works operators and ESP site manager. Regular planning meetings and a flexible approach ensured that existing plant was available to the contractor as required – weather permitting. Developing method statements with the plant operators was another way of ensuring operations went smoothly and time was not lost. The discovery of several unforeseen obstructions and services within the site also put the completion date at risk. The ability of the contractor and the ESP designers to revise the solution whilst maintaining progress, proved critical. With all team members understanding the background and details of the complicated site and project, the ability to overcome problems was maximised.

By working as an effective team the 31st March date for having the new storm tanks in use was achieved. ■

Note on the authors: *P.A. Taylor Spencer is Project Manager with MWH (Montgomery Watson Harza) and S.D. Jones is Project Manager with United Utilities.*