

Clatto WTW

£5.1m scheme to secure and improve water treatment for Dundee area

by
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The Clatto Water Treatment Works is the sole treatment facility supplying the City of Dundee as well as parts of southern Angus and the Carse of Gowrie in Perthshire, Scotland. Water is taken from both Lintrathen and Backwater reservoirs and supplies a distribution network that encompasses the Sidlaw Hills, Dundee, Errol to the south west and Carnoustie to the north west.



Moving coated steel pipe bend

Courtesy of Scottish Water Solutions

The refurbishment of the works, which serves a population of around 212,000, was the final stage of a £16m programme which included construction of a new underground reservoir.

The works was originally constructed between 1969 and 1971 to a design engineered by Patterson Candy for the East of Scotland Water Board. The works consisted of 10 Rapid Gravity filters, 27ML of treated water storage - which was later increased to 28ML - and three pyramidal washwater recovery tanks with dirty water wasted to the local sewer. The treatment process consisted of coagulation with aluminium; LT 22s polyelectrolyte dosing as coagulant/flocculation aid; direct, rapid gravity, dual media filtration; disinfection using chlorine gas; pH correction using hydrated lime and batch Wash Water Settlement. Throughput at the works varied from between 60MLd to 90MLd.

Project scope

The existing works suffered problems in treatment performance with PCV failures for coliforms, manganese (in network), aluminium and

pH. The sludge plant had inadequate treatment prior to returning the supernatant to the head of the works and the Drinking Water Quality Regulator determined that the level of disinfection control was inadequate to ensure consistent bacteriological compliance and taste. The drivers which needed to be addressed by the upgrade were DW3 Coliforms, manganese and turbidity, DW4 Cryptosporidium (WWR), DW13 Disinfection control and Capital Maintenance.

To meet DW3 the requirements were to increase chlorine contact time, provide dosing and/or extra filter capacity for manganese removal and renovate existing filters for turbidity. For DW4, to improve washwater recovery and control and for DW13, dosing and control of chlorination. The requirements of the Water Service Non-Infrastructure capital maintenance work included protecting the MCC from flooding, replacing flow control valves and installing standby generator autostart (Aird Walker & Ralston).

The original budget for the project was £9.05m with acceptance (beneficial use) due by March 2010.



Removing gravel, sand and anthracite from existing rapid gravity filter

Courtesy of Scottish Water Solutions

As the works is the sole supply for the area, the project team had to ensure that security of supply was maintained during the upgrade work particularly while rapid gravity filters were refurbished and treated water tanks were worked on. Each of the drivers individually and collectively posed significant design challenges for the team. Key issues included whether the filters could be refurbished to achieve the turbidity and manganese requirements; how chlorine contact time could be achieved within the restricted hydraulic regime at the plant; how improved wash-water recovery could be achieved and how would all of the above work together holistically. The project team and Scottish Water also identified that the budget and timescale for the project could be challenged while still delivering the drivers.

The project team addressed each of the issues in turn :-

Turbidity / Manganese: 2 of the 10 existing filters had been refurbished previously, and the project team used the operators' experience of this refurbishment when developing the agreed methodology for the work. Black & Veatch promoted the use of an off framework subcontractor (Western Carbons) to replace the filter media. To further improve the performance of the filters, the existing launder channels (Sui Generis) were also replaced as part of the filter refurbishment scope.

A hypochlorite dosing unit was installed to address the seasonal manganese problem. The alternatives would have been to install a DAF unit at the raw water source or construct a further bank of 3-4 filters which physically would be difficult to fit into the existing works. Both alternatives were also prohibitively expensive.

Chlorine Contact Time: The existing residence time at the Works was insufficient to meet the driver. This could be lengthened by increasing the existing contact tank sixfold, or through the provision of a new tank. Unfortunately, the confines of the existing site could not accommodate either of these proposals without the need for land purchase and planning / third party approval. Instead baffle curtains (Landline Containment Solutions) were used in the existing treated water reservoirs, a solution which drew of the designer's experience of similar issues on projects in England.

Washwater Recovery: The existing washwater recovery process was inefficient and could only comply with the requirements of the driver by discharging into the local sewerage network, direct to PFI WWTW. The design team installed a separate supernatant withdrawal

system in each of the existing pyramidal tanks to abstract at the water's surface. The process performance would be further enhanced by polymer dosing, 375m³ balancing tank (Kirk Environmental) and variable speed return pumps to maintain a return flow < 10NTU to the head of the works. Alternatives to delivering this quality driver would have been ultrafiltration/ lamella settling plants, again, extremely expensive by comparison.

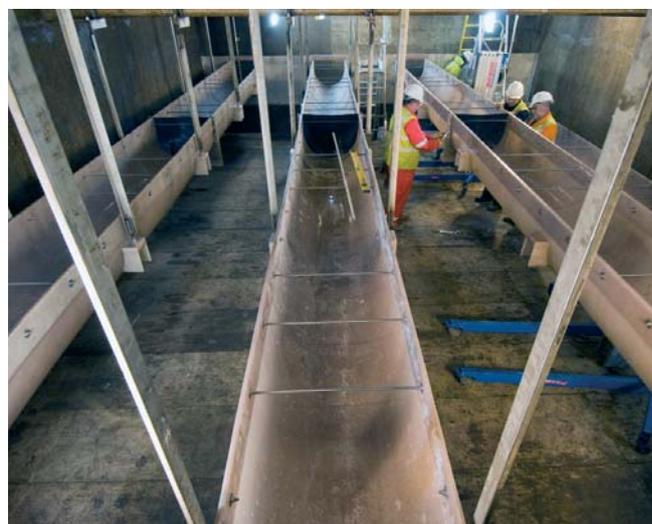
Disinfection Control: The delivery of the DW3 scope would ensure the requirements of DW13 would be achieved, ensuring the Disinfection Index (total chlorine) was less than or equal to 19.

Contract & Construction

Clatto was part of the 'Market Tested' programme of work for Solutions and Black and Veatch successfully bid for the work. A design and construct approach was used for the main contract. Significant benefits were brought to the project through B&V using their in-house expertise (formerly Patterson Candy) to bear on the project.

Schedule and Cost

A number of key areas of opportunity to shorten the overall programme were identified. The principal opportunity revolved around being able to refurbish pairs of filters rather than single filters.



Installing new GRP launder channels into existing rapid gravity filter

Courtesy of Scottish Water Solutions



Placing new gravel into rapid gravity filter



Courtesy of Scottish Water Solutions

As these activities lay on the critical path, close attention to meeting client operational requirements was needed to take full advantage of this opportunity.

To maintain this advantage the schedule had to be rigorously monitored on a weekly and monthly basis to keep to programme. B&V in partnership with Solutions and Scottish Water regularly reviewed progress and challenged ways of beating the schedule to maintain or improve progress. This allowed the project to advance the regulatory output by one whole financial year ahead of baseline and four months ahead of contract programme.

Throughout the work the project team worked very closely with Scottish Water Operations staff and the relationship proved to be key to effective completion ahead of schedule. On one occasion, a

changeover of raw water main to the works caused by a major leak caused turbidity spikes through the works and had the potential to delay performance testing. The Operations team worked during a weekend to change the main over in order not to delay this critical path activity near the end of the programme.

The project team outperformed ACIP with £3.95m efficiency and reached baseline acceptance a year ahead of the original target.

In addition there were zero accidents, environmental incidents or utility strikes during the construction period.

Note: The Editor and Publishers thank Andy McLaren, Project Manager with Scottish Water Solutions for providing the above article. ■

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