

Glenfarg WTW

£4.3m upgrade scheme to improve water treatment in Fife

by
George Smart

The Glenfarg Water Treatment Works supplies 180,000 customers in the Fife area. The investment has resulted in improved water quality, in particular minimising the risk of cryptosporidium entering the water supply. The project comprised of improvements to wash water, sludge recovery and disinfection; in addition to capital maintenance works.



New Sludge Thickener (constructed from precast construction) adjacent to the existing cast insitu with roof thickeners

Courtesy of Black & Veatch

A difficult scope of work was completed at the live water treatment works ahead of programme, significantly under budget, and with no significant health and safety or water quality incidents. Main contractor Black & Veatch was awarded the title of Most Considerate Site 2009 by the Considerate Constructors Scheme, a national initiative set up by the construction industry to encourage best practice.

Project Scope

Improvements were required to the existing 85MLD works to provide additional WWR facilities and a new sludge thickener together with improved chemical dosing/ mixing facilities and capital maintenance.

The detailed scope of the works was as follows:

Water Quality Scope

- Replace existing chlorination system and provide new static mixer
- Move lime dosing POA and provide new mixer, flow meter, and pH control system
- Improve flow measurement into contact tank
- New below ground sludge thickener tank
- Mixer and level detection in existing sludge holding tank
- New sludge transfer pumps and pipework
- New mixer in wash water recovery tank
- Upgrade poly dosing
- Benching and flushing mechanism in wash water recovery tank
- Supernatant pH and turbidity sampling / control.

Capital Maintenance Scope

- Improve maintenance access to DAF scrapers
- Replace DAF recycle pumps
- Replace 8 RGF valve actuators
- Replace RGF outlet valve float controls
- Replace RGF upwash pumps
- New actuators to control express water return to RGF inlet.

Project Challenges

Challenges addressed during design phase

The initial project scope was potentially difficult to achieve by the regulatory deadline of March 2010. The main factor was that a new contact tank had to be built which would require land purchase. To streamline the scope Scottish Water Solutions investigated approaches that would remove the need for the contact tank. As a result it was agreed with the authorities that the drivers would be met by simply providing a new chlorine cascade controller and sample delay loop to simulate the effect of the contact tank. This solution saved many months of work and reduced costs by several million pounds.

Challenges addressed during construction phase

An acceptance date of May 2009 was agreed but following the award of the contract to Black & Veatch, a request was made to bring the project forward so that all outputs could be claimed before the end of March 2009. The significant intrusive works and risks associated with this project meant the revised target posed a major challenge. By working in partnership and managing risk carefully, however, Scottish Water, Scottish Water Solutions and Black & Veatch were able to out perform the targets they had been set.



Completed installation of Chlorine static mixer Courtesy of Black & Veatch after only 2 No 6 hour shut downs of flows

Management of intrusive works

The main intrusive elements were the benching work in the large underground confined space wash water recovery tank, the installation of the chlorine static mixer, contact tank flow measurement, lime mixing waterchamp, and the installation of the sample return lines from the existing clear water tank (CWT). Each of these elements required either significant diversions of flows or controlled shut downs of the entire treatment works.

From day one the integrated project team understood this was a challenging scope in terms of health & safety, programme management, and ensuring water quality and supply.

In addition it was identified that there were numerous other projects in the same water network that would also require shut downs of outlet flows and that no two projects could turn off flows at the same time.

Black & Veatch was managing most of the other projects which had an impact on shutdown times and it was agreed that the Glenfarg flow shutdown would have to be undertaken between June and August 2008 to prevent delays to the works at nearby Lomond Hills WTW. As the Glenfarg design was not finalised at this time, and some equipment was subject to long lead-times, this target was potentially difficult to achieve.

To ensure water quality and supply during the work the delivery partners reviewed every aspect of the design to reduce the risks and undertook the following measures:

Contact tank flow measurement

The design called for the installation of an ultrasonic level detector and a new V-notch weir plate at the existing concrete broad crested weir. This required the weir to be partially demolished and rebuilt to a new level; resulting in an extended shutdown of the works. As an alternative Black & Veatch proposed a flow measurement device which did not require modifications to the existing weir, reducing HAVS, COSHH, and water quality risks significantly. This proposal also minimised confined space working and required a single six-hour flow shutdown.

Lime Mixing

The initial design called for the installation of a 4m-long pipe static mixer in the existing 1,200mm diameter concrete pipe between the contact tank and the CWT. Early liaison with Scottish Water operations staff determined that only a six-hour flow shutdown was possible. The installation proposed would be difficult to install during this window, creating possible construction, water quality and water supply implications. The project team proposed and installed a Waterchamp mixer in the channel just upstream of the 1,200mm diameter pipe. This solution still required two separate six-hour shutdowns, however, the work was managed with reduced risk to supplies, reduced confined space working, and no deep excavation risks.

Flow measurement for lime control

The design called for a magnetic flowmeter to be installed in the 1,200mm diameter pipe. In addition to the constraints noted for the lime mixer, there was also to be a new access chamber constructed around the existing pipe. Black & Veatch and Scottish Water Operations were both concerned about the risks of constructing a 2.1m diameter x 4m deep chamber around the only outlet pipe from the works. The project team considered several options before a final solution of improving flow measurement upstream of the contact tank, while retaining the existing pressure type flow meters on the up-wash lines, was adopted. This solution was installed with no deep excavations, no flooding risks, minimal confined space working, and reduced loss of water supply risks.

Installation of Chlorine Static Mixer

Following a review of the design drawings Black & Veatch saw an opportunity to improve mixing of the flows from all eight of the RGFs. This resulted in the mixer being installed in a revised location. In addition, Black & Veatch progressed the detailed design of the

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position, size and cover of the new access point to ensure the quantity and duration of flow shut downs and associated confined space working was minimised.

Environmental Issues

The project team was faced with a number of challenges in relation to environmental issues, including prevention of potable water contamination and unplanned cessation of flows as a result of numerous intrusive works.

Protecting the nearby Glenfarg Burn, along with trees and water courses, when constructing new 6m deep sludge thickener tank was also important.

The original design called for the new 6m-diameter x 6m-deep sludge thickener tank to be constructed with insitu concrete and a reinforced concrete roof slab. The design was reviewed and a precast-wall tank with no roof was proposed and implemented. This revision reduced raw material usage, and consequently vehicle movements; as well as cutting health and safety risks, and improving access for maintenance and cleaning.

The original design for the underground wash water tank benching required 2m x 2m insitu concrete fillets. Black & Veatch realised that constructing this in the existing confined, underground structure posed potential health and safety issues. An alternative layout was proposed and installed reducing health and safety risks and reducing the need to install some 160m³ of raw concrete materials.

Note: *Glenfarg WTW was a Scottish Water Solutions project with Black & Veatch as main contractor. The editor & publishers thank George Smart, Project Manager with Black & Veatch for the above article.* ■



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Glenfarg WTW, benefitting from the supply and support of basic process measurements like flow and level to analytical determinations of chlorine, turbidity and pH provides a good example of the holistic solution provided by a local supply and support company. Five different manufacturer products were engaged and managed. A clean water open channel flow metering system with an inherent accuracy suitable for chlorine dosing was sourced, supplied, engineered, installed and commissioned within ever tightening project timeframes by Processplus.

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