The Hawick Cluster

a £10m integrated solution to improve drinking water quality in the Scottish Borders

by
David Ross

Located around the town of Hawick in the scenic Scottish Borders, Roberton, Acreknowe and Dodburn water treatment plants collectively fed a large part of the Hawick Water Supply Zone. This covers a wide area of the Scottish Borders region, and the three independent works together served a population of around 43,000. Raw water comes from a number of inland reservoirs, water courses and springs, the largest of which is Alemoor Reservoir, which feeds Roberton WTW directly.

Aerial view of Roberton WTW Construction Phase *Courtesy of Biwater Leslie JV*

Existing Process

Dodburn WTW was a basic treatment site with a peak demand of 3.55Ml/day, and comprised burn intakes, slow sand filtration and disinfection treatment and with no on-site clear-water storage, the treated water went straight into supply.

Acreknowe WTW was again a basic treatment site with a 1.8Ml/day peak demand, with coarse screens at the inland reservoir outlet and an intermediate gas disinfection dosing station at close-by Flex village, which provided disinfection prior to the water going into supply. As with Dodburn, there was no clear-water storage.

Roberton WTW consisted of an inlet chamber (with confined space issues) sedimentation & filtration treatment and a final chlorine contact tank (CCT). The sludge handling system comprised a WRC thickener and centrifuge separator, with supernatant returning to the dirty wash-water tanks prior to feeding back to the inlet. The works had a peak demand of 10.5Ml/day.

Issues to Resolve

Analysis of recorded water quality data for the supply zone indicated the presence of a high level of bacteria, metals and minerals, which had led to a series of PCV (prescribed concentration value) failures on coli forms, e-coli, turbidity, manganese, clostridium, aluminium, trihalomethanes and lead. The level of disinfection control at all three plants was also inadequate to ensure consistent bacteriological compliance and taste and there was considered to be a high cryptosporidium risk.

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To comply with the lead directive of 25 ugl, the Dodburn site would have required the installation of orthophosphate dosing. At Acreknowe, the coarse screens required manual cleaning on a regular basis, which placed excessive demands on Scottish Water Networks to re-zone the supply during this activity. A number of threshold limit values (TLVs) had also been recorded at the site for iron. At Roberton, the sludge plant also failed to comply with the cryptosporidium directive, having inadequate treatment prior to returning the supernatant to the head of the works.

An holistic review across the Hawick Water Supply Zone concluded that abandonment of treatment facilities at both the Acreknowe and Dodburn works, with raw water flows transferred onwards to an upgraded treatment works at Roberton presented the most economic and cost-effective solution to address the Drinking Water Quality issues.

Integrated Solution

The Design & Build contract for Scottish Water Solutions was undertaken by Biwater Leslie Joint Venture with consulting engineers Faber Maunsell Farrer.

Acreknowe & Dodburn

In order to isolate and thereafter abandon the treatment works at Dodburn, the team developed proposals using the existing works overflow to transfer the raw water feed into Acreknowe Reservoir. Thereafter, a new pumping station on the site of the Acreknowe (Flex) dosing station and rising main transferred the combined raw water flows from Acreknowe onward to Roberton WTW for full treatment. It is envisaged that this pumped supply will only be required during times of high demand and after a prolonged spell of dry weather, when it will assist in the water level management of Alemoor Reservoir and reduce the risk of scour.

Wherever practicable, the original infrastructure was utilised to back feed the treated water from the newly upgraded Roberton WTW to the properties within the original Dodburn catchment. The existing service reservoir at Crumhaugh Hill was also retained and provides additional storage flexibility for times of planned maintenance.

A significant number of network changes were introduced through the construction phase to minimise any interruption of potable water supply to the very many properties which were affected by the works. The impact of the changes to the existing network, along with the significant lengths of additional new infrastructure required to deliver the overall scheme, necessitated highly detailed logistical design, preparation and installation programming. Access to string out the pipes across rural countryside presented a challenge which was addressed by the use of helicopters. A variety of construction techniques were also adopted for the construction to suit the changes in topography and ground conditions, and these included trenching machines, mole plough, traditional open cut, directional drilling and slip lining to deliver in total:

- 7.3 km of 315mm HPPE & 355mm HPPE twin track;
- 3.3 km of 315mm HPPE single track;
- 1.5 km of 355mm HPPE single track;
- 4.1 km of 90mm HDPE single track;
- 5.5 km of 63mm HDPE single track;
- 2.8 km of 160mm HPPE slip lining inside 21” cast-iron pipe.

Roberton WTW

Roberton WTW was originally constructed in 1964 to treat a raw water inflow of 9 Ml/day. In 1998 the works capacity was increased to 11.36Ml/day with the addition of a new inlet works, distribution chamber, clarifier and chemical dosing systems. Following the abandonment of Dodburn and Acreknowe, the capacity of the works

Dodburn WTW – Existing works to be abandoned included slow sand filtration beds and disinfection processes *Courtesy of Biwater Leslie JV*

Mole Plough installing alkothene pipe across fields *Courtesy of Biwater Leslie JV*

was increased to 16.2Ml/day to accommodate the additional flows from the new Flex pumping station. The existing inlet chamber was replaced with a new inlet works and a new distribution chamber was constructed to split the flows between new, two-stream up-flow clarifiers and the existing sedimentation process. Thereafter, flows combine to feed the existing six primary filters.

Due to hydraulic constraints within the existing chlorine contact tank, a new 800mm diameter gravity main was laid across the site to feed a new two-lane CCT, with the existing tank decommissioned upon project completion. Existing chlorine and caustic dosing points were relocated downstream of the CCT, with existing ammonium sulphate and orthophosphoric acid dosing plants being utilised. On-site potable water storage capacity was increased with an additional reinforced concrete 1580cum capacity clear-water tank adjacent to the existing twin tanks. Historically, varying sludge consistencies had proved problematic for the existing sludge centrifuge system, resulting in turbidity issues when the supernatant was returned at the head of the works. This system was replaced with a new WRc thickener tank, which produces a more stable and consistent sludge and supernatant. This also allowed the redundant sludge buffer and thickener tanks, to be modified and reused to provide increased sludge storage for the higher throughput. A new sludge press plant was also installed, which reduces the sludge storage requirements of the site with consequent reductions in both traffic movements and costs associated with sludge removal.

The scheme was complicated by the requirement to maintain a continuous supply of treated potable water throughout the construction and installation phase and the integration and on-line commissioning of the new processes presented a considerable logistical challenge. Cooperation and coordination between all of the stakeholders was key to the success of the project, which is due to be completed in August 2010.

Note: ***The author of this article, David Ross, is a Director of George Leslie Ltd, and Framework Manager for Biwater Leslie Joint Venture.***■

Trencher excavating for rising main *Courtesy of Biwater Leslie JV*

Air delivery of pipe materials reduced traffic movement across unsuitable ground *Courtesy of Biwater Leslie JV*