

Bullamoor Service Reservoir

improved security of supply to two Yorkshire areas

By
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This project forms part of the Yorkshire Water Services Ltd's water treatment works (WTW) Rationalisation Strategy. In the Northallerton and Thirsk Production Management Zone (PMZ) this includes the closure of Osmotherley WTW and the increase in output of Thornton Stewart WTW to 33 MI/d. The Bullamoor service reservoir (SRE) complex comprised three tanks with a total capacity of 4.5MI and now forms the hub of the distribution system with inputs from two local WTWs. The forecast zone demand (average day peak week) for 2029/30 is 16.7MI/d. Network modelling of the trunk main system, undertaken using Aquis software to determine the required storage under different failure scenarios, showed that an additional 8MI was required. This was based on future demands of the supply areas and estimated repair times for the key inlet main.



Aerial view of completed increased capacity at Bullamoor Service Reservoir

photo courtesy Costain Ltd

Options

Five options were identified at a Risk & Value study for providing the total storage including differing combinations of re-using the existing tanks. Detailed cost estimates showed that the lowest Net Present Cost (NPC) option was to provide the additional 8MI as a new tank (T4) adjacent to the existing tanks. Whilst needing to work hydraulically with the existing tanks, a deeper tank with a higher top water level enabled a smaller footprint tank to be built.

Design

The twin compartment reinforced concrete tank 45m x 45m in plan with a nominal water depth of 4m was founded on mudstone. The tank included design principles recently introduced by YWS.

- * Monolithic construction
- * Watertight doors

Historically, the source of bacteriological contamination of service reservoirs has been ingress through joints. In order to reduce this risk the tank was designed as a monolithic box using finite element

analysis the only joints being construction joints, which incorporated a hydrophilic water stop, Hydrotite CJ.

To enable safe access into the tank for cleaning, without the use of ladders, inward opening watertight doors have been incorporated into the outlet valve chamber, leading to an internal precast concrete staircase. The security of the tank is enhanced by the elimination of covers on the roof. Level instrumentation is accessed by two apertures (with insect mesh) in the inlet valve chamber above top water level.

With the top water level of T4 being higher than the existing tanks an actuated eccentric plug valve was used to control flow to these tanks. The valve was controlled on the level in the receiving tanks. Even though the site has a permanently installed standby generator, the actuator selected was fail-safe, in that it would close in the event of loss of power to prevent them overflowing.

The two sources supplying Bullamoor SRE have differing hardness. A programmable logic controller (PLC) ensures appropriate ratios



Tank 4 under construction

photo courtesy Costain Ltd

arrive at T4 where the inlet/outlet arrangements have been designed to provide adequate in-tank mixing.

Extensive use was made of wall couplers where pipework passed through concrete walls. these simplify shuttering and eliminate the need for leak-prone boxouts.

The project included rationalisation of the operation of the existing tanks. Each is now fed from T4 via a common inlet main and provides at least 24 hours storage for its defined supply area. T4 has a separate outlet main supplying the rest of the PMZ.

Construction

An enabling works contract to divert existing water mains from the area of the new tank was commenced in July 2006. The construction programme was extremely tight but additional capacity was available by 31st December 2006 to allow the closure of Osmotherly WTW in accordance with the DWI Undertaking. Four factors contributed to the reduced construction period (and hence costs):

- * use of off-site prefabricated reinforcement;
- * lack of joints (other than construction joints);
- * pre-cast concrete roof panels as permanent formwork;
- * the use of Zemdrain® formwork liner to produce a high quality durable concrete, which required minimal surface finishing.

Environmental /Planning Issues

Planned extensive landscape bunding utilising excavated material

resulted in reduced material being transported to landfill, with both environmental and cost benefits.

The planning approval was subject to a soft landscaping plan. Following completion, after the grass on the embankments had grown, it was considered to be sufficiently unobtrusive that the Planners agreed to remove the condition for landscaping.

Third parties

Bunding was used to screen the view from the adjacent Public House. The other adjacent landowner, from whom the site for the new tank was purchased, was kept fully informed of construction activities and access maintained for their agricultural purposes until the permanent access was in place.

The team

This project was delivered for YWS by the AMP4 Clean Water (East) Joint Delivery Team (JDT), which comprises YWS and Costain Ltd. Design consultancy services were provided by Mouchel. All staff involved, working as Costain Mouchel (formerly Costain MP) were co-located at offices in Castleford, W.Yorkshire.

Project out-turn costs are in the order of £2.7m

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