

Rivelin WTW

process upgrades to resolve manganese problems

by Fred Mukonoweshuro BSc, MSc, CEng, MICE, MCIWEM and Matthew Jenkins MEng, CEng, MICE

Located on the outskirts of West Sheffield, Rivelin Water Treatment Works (WTW) is a key Yorkshire Water Services (YWS) asset supplying a number of production management zones in the Sheffield area. The plant was originally commissioned in the early 1990s and was designed to treat moorland water from the Derwent Valley Reservoir. The works has a maximum design capacity of 75ML/d and operates at an average throughput of 53ML/d.



Rivelin WTW - Courtesy of Peter Smith Photography

Background

Rivelin WTW is one of the few works in the UK that uses the Sirofloc process technology as a front end process for colour and turbidity removal. The Sirofloc process is a unique process invented by Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia. It is an alternative to metal-ion coagulation process for water treatment. The process uses micro-sized magnetite (naturally occurring), a high grade iron ore, to adsorb the impurities in the raw water and can be chemically cleaned and regenerated for reuse.

In February 2010, an undertaking issued by the Drinking Water Inspectorate (DWI) identified that the levels of manganese concentration are being exceeded, or are at risk of exceeding, the prescribed concentrations in the Rivelin supply zones because high levels in raw water were not removed at Rivelin WTW.

The existing first stage process, rapid gravity filters (RGFs), can deal with certain levels of manganese but is unable to cope with elevated or seasonal spikes of manganese concentration.

Solution

The solution to the problem was promoted through the YWS AMP5 Large Scheme Programme. As part of the AMP5 procurement process the project was investigated as Rivelin Batch package of work where the water quality driver for investment incorporated a number of Base Maintenance issues into the scope of work thereby promoting a more strategic and holistic approach towards the long term performance of the works. In this manner a greater, sustainable, robustness to the operation of the works will be secured whilst ensuring efficiency use of investment.

Undertakings

The Rivelin Batch work was awarded to Mott MacDonald Bentley (MMB), one of the four framework contract partners for YWS AMP5 programme. As part of their remit, MMB carried out investigations into areas such as asset condition, flows and loads, environmental surveys and geotechnical investigation including optioneering and development of the preferred option with the assistance from Arup as the technical consultant. Turner & Townsend are the commercial consultants.



Architects

Water
Waste Management
Planning
Environmental
Industrial
Sustainable Design
Commercial
Education
Health
Visualisation

3 Vincent House | Solly Street
Sheffield | S1 4BB
tel: 0114 273 7050
fax: 0114 273 7881
web: www.racecottom.com

**RACE
COTTOM
ASSOCIATES**

Circle

Control & Design Systems

Tel: 01423 323900

Fax: 01423 323304

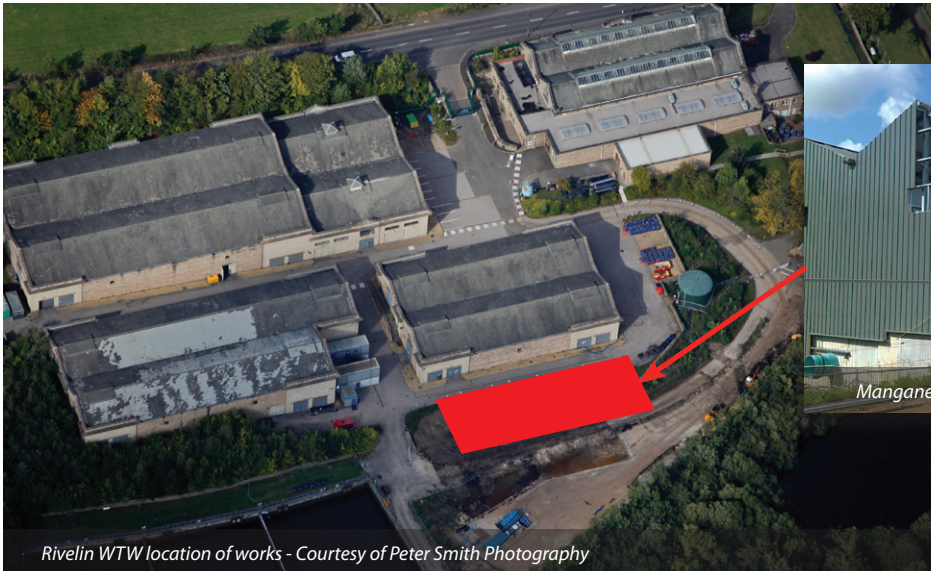
Email: postmaster@circle-control.co.uk

Electrical Contractors

Specialist Electrical Contractors to the Water Industry.



Unit 8, The Poplars Industrial Estate, Wetherby Road, Boroughbridge, North Yorkshire YO51 9HS



Rivelin WTW location of works - Courtesy of Peter Smith Photography



Manganese treatment plant building - Courtesy of Arup

Preferred option

The preferred option confirmed that manganese contactor filters were best suited to deal with this problem. Manganese contactor filters are a well proven and robust process for dealing with manganese. In addition to the manganese removal, these filters provide a further defence/protection to the downstream process in the event of turbidity breakthrough at the stage one process. The option for using a pressure filter housed in an existing building was considered as an alternative but was discarded on operational grounds.

Design

Following review with YWS and Arup, the preferred option was developed into full design upon which a design and build tender

submissions was produced. The project tender prices were set through a negotiated route leading to a contract being signed in August 2011 for a value of £7m. The scope of the works agreed comprised 6 (No.) manganese contactor filters with a total design capacity of 75ML/d to be housed in a new building. The scope also included an associated ancillary works. The new building required a planning application which was obtained with full cooperation of the local environmental groups.

The design development process benefitted from a committed team comprising MMB, Arup, and YWS with the active participation of key YWS stakeholders. The well attended design development sessions indicated keen Client interest in finding sound engineering solutions with capital efficiency benefits.

CARLOW PRECAST

Concrete Engineering

IRL Head Office
Tel: +353 (0)59 915 9550
info@carlowprecast.com

Design • Manufacture • Deliver • Install

U.K. Head Office
Tel: 0870 493 1408
info@carlowprecast.com





SERVICES

FST STRUCTURES • SPILLWAYS • AMP 5 RESERVOIRS • ASP STRUCTURES

• STORMWATER ATTENUATION TANKS



WWW.CARLOWPRECAST.CO.UK



Integral to the design process was the use of a 3D model for the new plant. This aided various reviews process including design, hazards in operation and construction, access and lifting, pipework and cable tray installations. The model was also a useful tool for planning and monitoring the construction sequence.

Construction

Construction of the new manganese removal plant started in November 2011. There was sufficient space within the existing treatment works boundary to accommodate the new plant. This was strategically located to minimise its visual impact on the sensitive local environment with Rivelin WTW being situated on the edge of Peak District National Park.

The 6 (No.) contactor filters were to be constructed on top of a new treated water holding tank. The associated ancillary works, the blowers, backwash and new high lift pumps were situated on an adjacent slab, with the whole process being contained within one steel framed building.

The building will be timber clad to blend in with the rural surroundings. The backwash pumps will serve a dual duty, also supplying the existing RGFs which remain as part of the process. The new high lift pumps will then replace the existing, delivering potable water into the distribution network via a local service reservoir.

Precast benefits

A precast construction method was employed in preference to the more traditional cast in-situ approach, the first time this construction process have been used on a YW water treatment site on such a scale and for filter tanks. This brought significant programme benefits saving more than 6 weeks and enabled a high quality product to be produced under factory conditions. There were also added H&S benefits, minimising the need for working at height and storage of large shutters on a restricted site.

Following construction of the treated water holding tank base on piled ground beams, the large free-standing panels shipped from Ireland (supplied by Carlow Precast Engineering, Ireland) were quickly erected to form the main structure. The tallest panels were 8m high and infill pours were necessary to structurally complete the plant. Some early manufacturing issues were resolved and the construction schedule met, despite some harsh winter weather through proactive intervention and management from the site team.

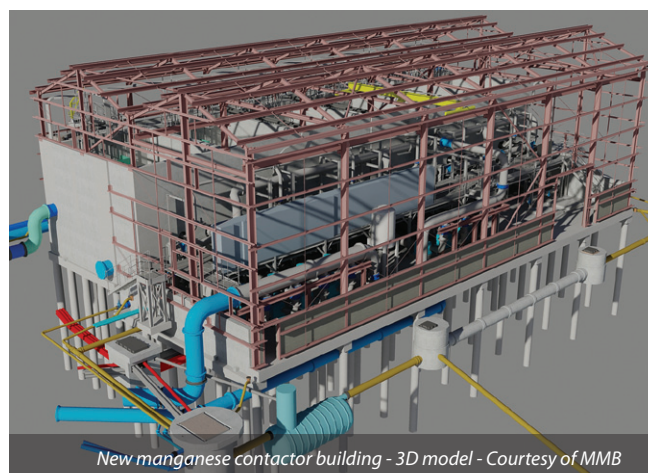
Progress

At the time of writing (June 2012) the main structure is complete and weatherproof with the inner skin of cladding installed on the steel frame. The main pipework connections are made to the existing works, carefully sequenced to minimise operational disruption. Tie-ins were carried out concurrently with work shut downs required for Phase 1 chemical dosing interfaces.

Mechanical & electrical installation of the process equipment is now the main construction activity, through subcontractor ACWA Services. Water tests on the contactors will continue simultaneously with the Leopold flooring installation to follow within the treatment tanks.

The project is on course to have the new plant fully operational in time for the DWI compliance date of December 2012. Commissioning activities are being carefully planned, taking account of operational interfaces and contingency measures at fortnightly Joint Commissioning Team (JCT) meetings.

The editor & publishers would like to thank Fred Mukonoweshuro, and Matthew Jenkins, both Senior Engineers with Arup, for providing the above article for publication.



New manganese contactor building - 3D model - Courtesy of MMB



Precast panel installation - Courtesy of Arup



Portal frame for the building being erected - Courtesy of Arup



Manganese building facade installation - Courtesy of Arup