Maple Brook Pumping Station

refurbishment of a 100 year old pumping station to ensure reliability of supply for the next 25 years

by Dan Hickman MSc

South Staffs Water's Maple Brook Pumping Station is located approximately two kilometres northeast of Burntwood in Staffordshire and it serves approximately 50,000 people in the area. The pumping station has undergone a programme of refurbishment to ensure its continued capacity to abstract groundwater for delivery into the local potable water distribution system, and to providing an emergency supply of tankered water. Maple Brook Pumping Station Refurbishment was placed in the investment programme due to the age and reliability of the existing operating equipment.

The old pump house at Maple Brook
Courtesy of Imtech Water, Waste & Energy

The original triple expansion steam engine, installed circa 1905
Courtesy of Imtech Water, Waste & Energy

New bore building
Courtesy of Imtech Water, Waste & Energy

New bore buildings no 5 and no 6
Courtesy of Imtech Water, Waste & Energy

Background

The Maple Brook Pumping Station site was originally developed from 1911 through to 1922 and eventually had two stream driven pumps. The site was electrified in 1972 and one of the steam engines was retained although no longer in use.

The age of the plant has resulted in the obsolescence of the electro-mechanical drives and controls, which also pose a Health and Safety risk to operators and maintenance staff. When combined with two new boreholes, the object of the refurbishment work was to maximise the average and peak output from the source, whilst ensuring operational resilience and minimising whole-life costs.

Together with the basic requirement to refurbish the pumping station, a number of specific items were also included in the scope of works. These will ensure that the works deliver a refurbished station which is fit for purpose over a 25-year timeframe. In addition, two new boreholes had to be integrated into the station.

Boreholes

The existing site comprised four boreholes housed inside the pumping station. The boreholes were constructed in two phases (MB1 and MB2 in 1911/1912; MB3 and MB4 in 1921/1922). All were drilled to depths of 190–198m, at an initial diameter of 36 inches (914mm), reducing to 20 inches (508mm) through a succession of diameter changes. All four have grouted solid casing installed to depths of 33–37m. Below this, perforated steel casing is installed to 93m. All four boreholes are open hole below the perforated lining.

The pumping station also contains:

- Chemical dosing equipment to provide disinfection.
- Electrical control equipment including automation for control and SCADA for remote monitoring.
- Instrumentation for flow, pressure, depth, turbidity and chlorination.
- HV transformers.

Scope of work

The existing borehole pumping plant and headworks had to be replaced. Each of the four borehole pumps are submersible units, using the existing 150mm rising mains for boreholes 1 and 4 and with new 200mm diameter rising mains for boreholes 5 and 6. Each of the pumps is designed for potable and variable speed duty.

Flow meters, turbidity monitors and sample lines/sinks have been installed, to measure discharge from each of the boreholes. Boreholes five and six are remote from the existing building and new civil structures have been required around the headworks. Cross-site pipework was also required, of 200mm diameter, and the booster plant replaced.

The following items needed to be addressed, as part of the overall refurbishment:

- Refurbishment of the pumping station.
- Installation of turbidity monitors on all borehole discharges and the final water.
- Overhaul of the chlorine dosing plant.
- Replacement of the final water chlorine monitor.
- Replacement of the pressure monitoring equipment.
- Replace or install borehole depth monitoring equipment.
- Bringing the new boreholes into supply.

The MCC also needed replacing to ensure that the site was adequately powered. An estimate of the harmonic load was used to determine whether a harmonic survey was required to ascertain the need, or otherwise, for low harmonic VSDs. Due to the remote location of boreholes 5 and 6, it was thought best to co-locate the VSDs with the borehole head works building, in a separate room. The design included roadways, to service the remote borehole, and any remedial works that were required to the secure stock proof fencing around the existing site line.

It was necessary to fit a turbidity meter, sample line and duplicated pressure monitors to each borehole pump delivery, after the flowmeter and before the non-return valve and isolation valve. A borehole and booster run to waste (with automated valves) has been provided. The flowmeter on the run to waste facility was of MCerts Standards.

Automated dechlorination on the booster run to waste or contact tank overflow was also included. Where pipework has been replaced, then the existing floors and walls have also been tiled with the nearest match to the existing tiles. Plates were fitted over the holes caused by the removal of pipework. The GEM80 PLC was replaced with a new control system, based on Allen Bradley platform hardware.

A type two asbestos report was produced in November 2010 and there were no positive identifications of asbestos. However, presumptive asbestos was identified on the crane brake pads, pipework gaskets and within electrical panels. But the electrical panels, basement ducts, chemical dosing store, HV room and the roof and other high level areas were not examined as part of the report.

Further work carried out included the removal of the old transformers and booster regulators, the HV transformers were replaced with a single transformer, and domestic electrics and internal lighting were replaced.

Considerations

The site is located within a quiet rural and residential area, with access to the site off a bend in an adjacent road. This caused access restrictions with regards to the timing of deliveries, so as not to cause nuisance or block the road. The site is also used as a training facility, a function that had to be retained, but during construction this was not operational. There is also an emergency tanker filling point on the site that was available for use, until the pumping station was taken out of service, during the construction period.

The entire site remained a working area throughout the civil construction period. While the pumping plant was operational, the contractor had to cooperate with SSW operational staff – and when necessary the tankering staff – to retain full operational functionality and maintenance of the station.

A waste management plan was put in place before commencement of construction and was maintained throughout. All obsolete plant, with the exception of the existing borehole pump/motor assemblies, and surplus materials were removed from the station, while the existing borehole pump/motor assemblies were retained and passed over to production.

Undertakings

Work commenced at Maple Brook Pumping Station on 1st October 2012 and the refurbishment work was completed on 21st May 2013. The work was carried out by Imtech Water, Waste & Energy, working closely with South Staffs Water. The refurbished pumping station is now capable of abstracting between 8-10ML/d of groundwater for delivery into the local potable water distribution system, and to provide an emergency supply of tankered water.

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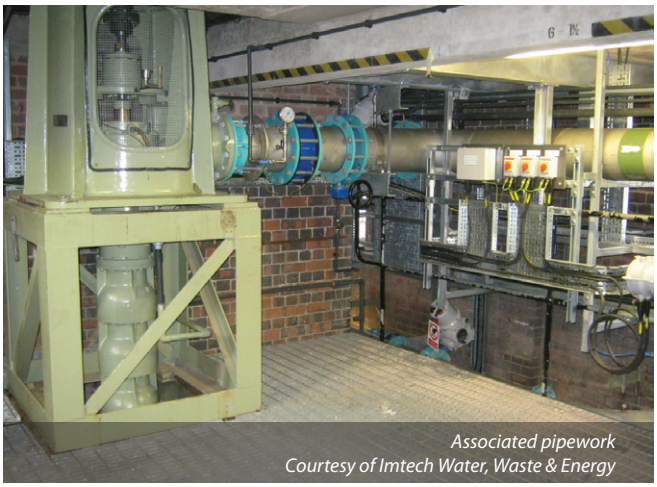
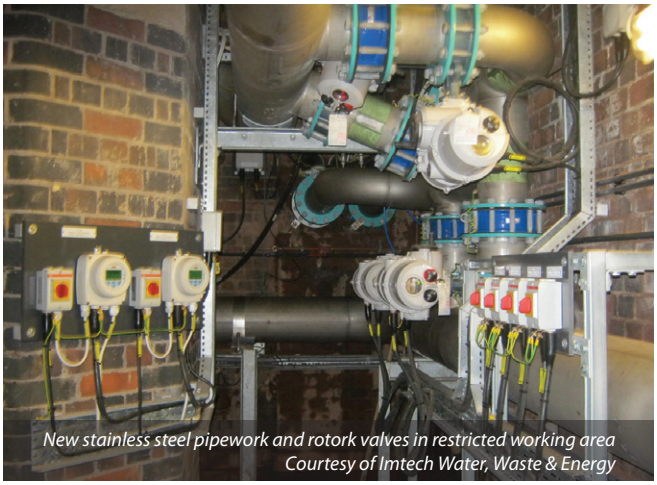


Associated pipework
Courtesy of Imtech Water, Waste & Energy



New stainless steel pipework and rotork valves in restricted working area
Courtesy of Imtech Water, Waste & Energy

New MCC and booster pump motors - Courtesy of Imtech Water, Waste & Energy