Dorney Water Treatment Works

cryptosporidium removal plant for borehole water

by
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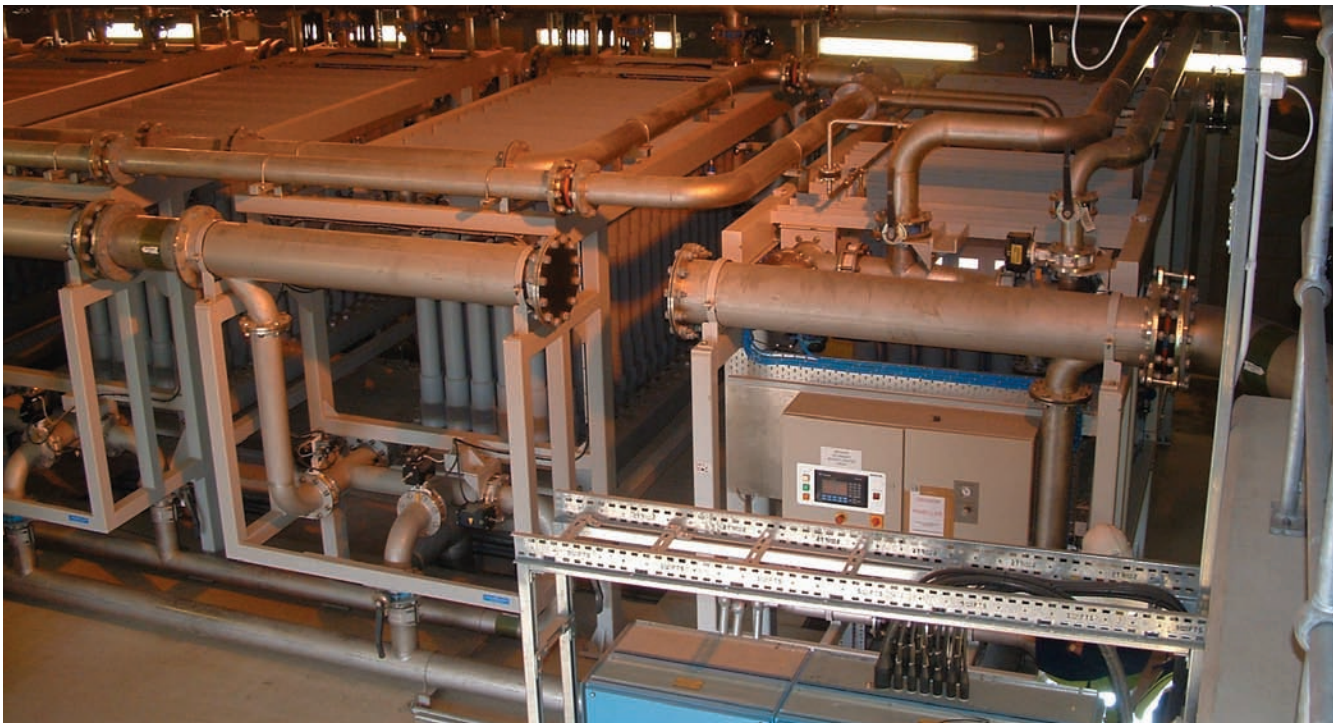
Dorney WTW, located to the west of Slough, has a treatment capacity of 54 Ml/d and treats water pumped from boreholes located at two nearby sites, Dorney Reach and Taplow Mill. The Dorney Reach boreholes were assessed by Thames Water as 'at risk' from contamination by cryptosporidium and Thames agreed with the Drinking Water Inspectorate to provide cryptosporidium protection during the AMP3 period in order to comply with the Water Supply (Water Quality) (Amendment) Regulations 1999. The agreed statement of intent stipulated a completion of commissioning date of the end of March 2003. The purpose of this scheme is, therefore, to form a cryptosporidium barrier for Dorney Reach borehole water and prevent its transfer into supply.



High level Memcor units (*Courtesy Memcor & Thames Water)*

Within the existing works, Taplow Mill water is treated by pressurised media filters and then blended with the raw water from Dorney Reach because of the high levels of nitrates found in several of the borehole sources. The combined streams then pass through the existing GAC filters before chlorination and delivery to supply.

The boreholes pump groundwater predominantly from river gravel strata adjacent to the River Thames and are particularly influenced by high river levels e.g. winter flooding. The river water can be highly turbid and could potentially contain Cryptosporidia. As such, the nine Dorney Reach boreholes were considered to be at significant risk of Cryptosporidium.

The Dorney Reach source is critical in meeting demand in Slough/ Wycombe/Aylesbury, which currently has 204 Ml/d of available supply. Availability could only be ensured if additional treatment was provided at Dorney WTW.

Membrane Treatment Plant

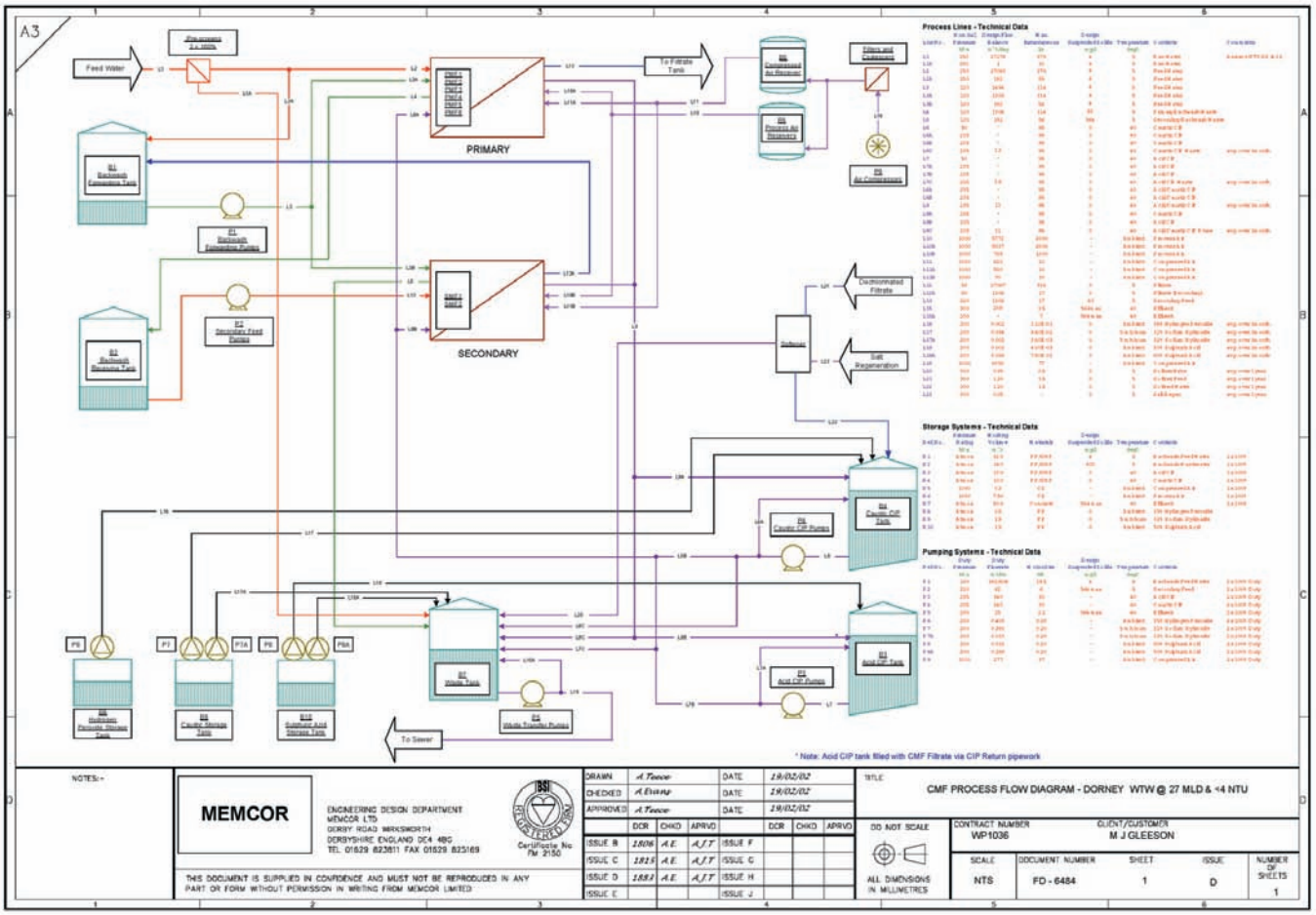
The Membrane Treatment Plant provides a membrane filtration system that will provide a 99.99% removal barrier to cryptosporidium for up to 27 Ml/d of Dorney Reach borehole water in a single filtration stage. A secondary benefit is that turbidity of the water ex-plant will improve from up to 8 NTU to ≤ 0.1 NTU.

The wastewater volume from the membrane plant will be minimised by the provision of secondary membranes to treat the primary filter backwash water. Secondary filtrate will be returned to the process for treatment and secondary waste will be discharged to the adjacent Burnham Sewage Pumping Station.

The filtrate is boosted up to 6.5 bar by new variable speed membrane filtrate pumps and fed back into the existing works. The filtrate pumps are started in conjunction with the borehole pumps at Taplow Mill to ensure adequate blending of water from the two sources. The remainder of the existing plant configuration remains unchanged.

The membrane contractor selected in the process design for Dorney WTW was *Memcor Ltd*. The *Memcor* system offered the most superior system technically with the lowest cost, least commercial risk and most beneficial delivery period over the other suppliers.

The *Memcor Membrane Plant* is contained within a new building. The rising main from Dorney Reach boreholes has been diverted



Schematic of cryptosporidium plant *(Courtesy Memcor & Thames Water)*

within the existing Dorney WTW site and the existing site power supply has been upgraded to accommodate the membrane plant.

Dorney Reach borehole pumps
Original pumps in the Dorney Reach boreholes have been replaced with lower delivery head *Grunfoss* pumps, rated to achieve the maximum daily output of 27 Ml/d, sufficient to feed water directly through the Primary Membrane Filters to the Membrane Filtrate Tank.

Pre-screen units
Two 100% Pre-Screen units have been provided to prevent damage to the membrane by gross solids. These comprise self-cleaning microfilters with a pore size of 500 microns.

Primary Membrane Filtration Units
Six Memcor 102M10C CMF Primary Filtration Units were provided and the maximum design output can be achieved with five in use and one standby. The standby unit is used when one unit is out of service for backwashing so as to maintain the maximum design output.

Second Membrane Filtration Units
Two 100% *Memcor 48M10C* CMF Secondary Filtration backwashing units are used to provide redundancy when one secondary unit is out of service for maintenance/clean in place.

Feed & backwash system
A common system has been provided to supply feed and backwash to both primary and secondary filtration units. The frequency of backwash is dependant on the raw water turbidity and is normally 60 minutes. The backwash air supply system also supplied process air for the primary and secondary units and pneumatic air for control of process valves.

Clean-in-place (CIP) system
A CIP system is used to provide cleaning chemicals to primary and secondary filtration units. Caustic (sodium hydroxide), acid (sulphuric acid) and hydrogen peroxide cleaning solutions are prepared in two separate tanks, one for caustic and hydrogen peroxide and one for acid. The caustic clean solution can be used five times whereas the acid and hydrogen peroxide solutions are not reused.

The CIP intervals are shown in the following table

Table 1 CIP Interval

CIP Type	Interval
Caustic	28 days primary
	7 days secondary
Acid	56 days primary
	14 days
Hydrogen Peroxide	180 days primary
	180 days

Waste tank
Wastewater is neutralised in the waste tank prior to discharge to the existing Burnham Sewage PS. In the event that the secondary filter units are out of use the facility to divert the primary filter unit waste to the waste tank has been provided.

Filtrate tank/pumping system
Filtrate from the primary filtrate units discharges into the filtrate tank. The filtrate is pumped into the existing works by new variable speed pumps where it is blended with the Taplow Mill water. Operation of the pumps is determined by flow rate through the filtration units.

Electrical system
Scottish & Southern, the regional electricity company, provided a

new supply to cater for the existing plant, the membrane plant and a potential membrane plant for Taplow Mill borehole water. It consists of an automatically switched 11kV dual supply fed from independent primary substations. Each of the two 1500KVA transformers is capable of supporting the whole site. The equipment is owned and maintained by *Scottish & Southern*, thereby reducing maintenance and operating costs and negating the need for standby generation.

Control & instrumentation

Control of the borehole pumps and hence the flow through the works is carried out remotely from Thames Water's Bourne End Control Centre (BECC). Output is varied by changing the number of pumps running and is determined by levels in the Stokewood and St Leonard's Reservoirs and demand from Slough ring main. New raw feed water and filtrate turbidity and flow meters have been provided at Dorney WTW and this information together with membrane plant status information, alarm states and indications are relayed to BECC and used to control plant.

Design & Construction team

Design, construction and commissioning of the membrane plant was carried out by Thames Water's *Trident West Alliance*, one of three partnerships forming the *Trident Alliance* established by Thames Water to deliver, through collaborative working, the majority of their AMP3 process projects. Trident West comprises Thames Water, MJ Gleeson and MWH.

Project approval was given in April 2002 with a challenging 12 month delivery programme. Key to success of the project was the innovative extension of the supply chain in the appointment of *Memcor Ltd* on a two stage procurement process (design separated from supply/installation/commissioning) and exceptional teamwork that took place throughout the duration of the project. This was emphasised in the erection of the building with valued contributions from *Elland* on the building superstructure, *Simanda* on cladding and *Maysair* on the HVAC. The co-location of *Trident West and Memcor* design resources gave the project team maximum flexibility and enabled early input of specialist product knowledge to produce a simple and safe to build scheme.

Through the project team's commitment and the use of Thames Water's health and safety procedures, the project achieved its time , cost and quality targets with zero lost time injuries or unplanned operational outages. The membrane plant produced filtered water into supply ahead of the 31st March 2003 deadline and optimisation is underway. ■

Note: *The author of this article, Duncan Stewart, is Senior Project Manager with Thames Water.*