Corfe Mullen, Dorset

Cryptosporidium protection scheme

by
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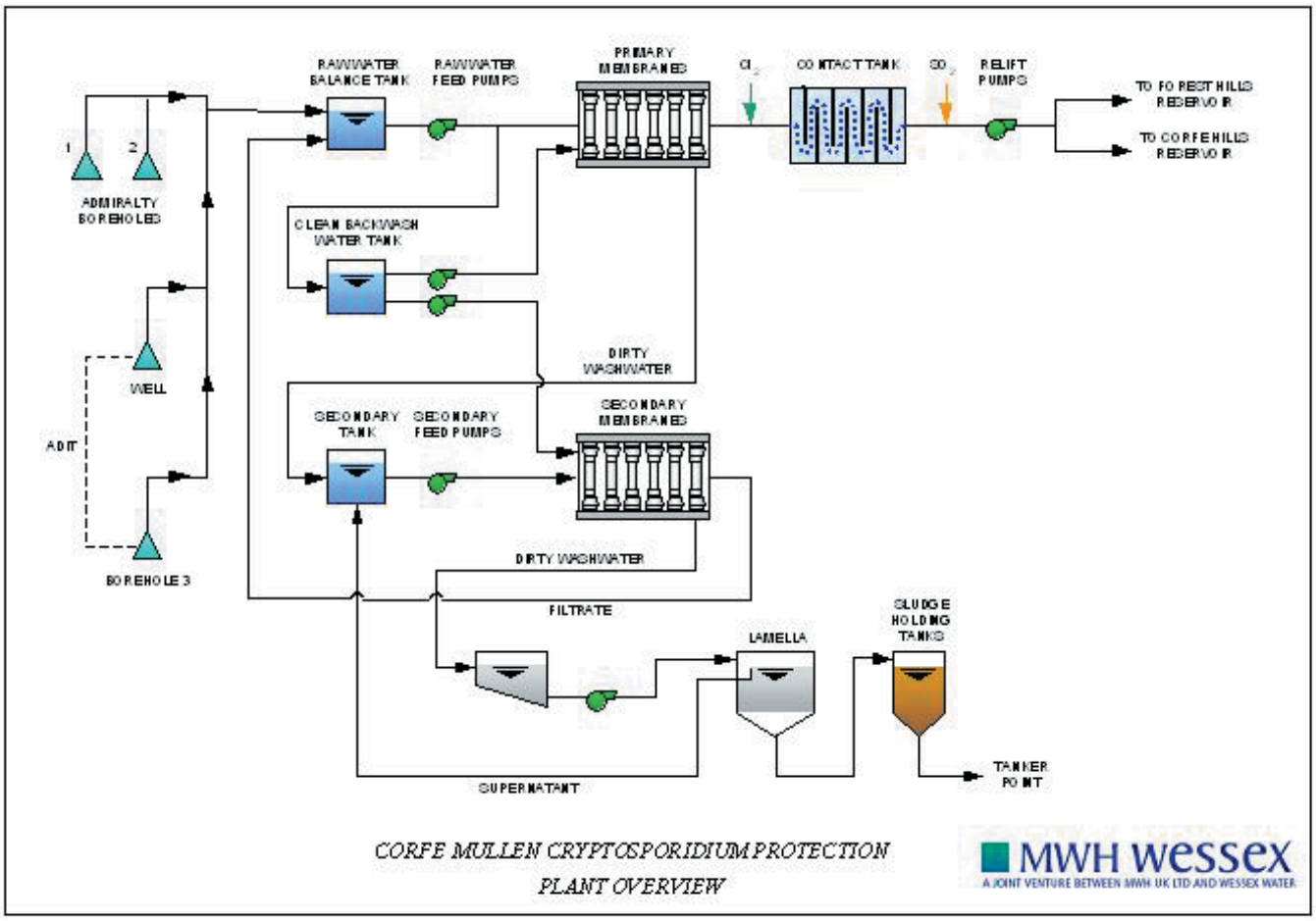
Following a risk assessment in 1999, the Corfe Mullen sources, comprising the Admiralty boreholes 1 and 2 and the on-site borehole 3 and well, were identified as 'at risk' from contamination by *cryptosporidium.* Wessex Water agreed with the Drinking Water Inspectorate to provide *cryptosporidium* protection during the AMP3 period in order to comply with The Water Supply (Water Quality) (Amendment) Regulations 1999.



The works is located some 300m south of the River Stour at the junction of the A350 and B3074, north of Poole. The rated output of the plant is 33 Ml/d, although the normal maximum output is only 28Ml/d. The existing works comprises:

* 8 rapid gravity sand filters. There is no chemical treatment prior to the filters;
* chlorination;
* chlorine contact tank;
* dechlorination with sulphur dioxide;
* washwater recovery tanks and sludge lagoon;
* high lift pumping station to Corfe Hills and Forest Hills reservoirs comprising two variable speed pumps at 26 Ml/d each, and one fixed speed pump at 7 Ml/d.

The sources suffer frequent turbidity spikes during periods of heavy rain and it was concluded that the existing treatment process did not provide adequate protection against *cryptosporidium.*

Membranes were identified as the most appropriate treatment technology.

Pilot plant investigation

Corfe Mullen WTW was identified as an ideal site for pilot trials because of frequent turbidity events resulting from surface water intrusion into the ground water supply. Turbidity peaks in excess of 1.5 NTU are frequently recorded at the site.

Pilot trials were undertaken with three membrane suppliers to demonstrate the performance of the technology. An initial selection process was conducted to determine the most suitable membrane systems to test at pilot scale. In particular, the selection criteria included:

* DWI approved system;
* adequate support services;
* a suitable integrity checking and membrane repair system.

Two Ultrafiltration (UF) systems together with one Microfiltration (MF) system were tested. All three systems were hollow fine fibre membranes, operating in dead end mode, however, each system employed a different membrane material and operating regime. Adequate performance was demonstrated by all three systems, removals in excess of 90% were demonstrated for all determinants. The plants typically achieved recoveries of between 95 to 98%.

Backflushing performance was identified as a key restraint for efficient system operation. The trial indicated that the MF system offered by *Memcor* was capable of sustained operation at higher turbidities than the two UF plants, due to the more effective gas backflushing system employed.

Chemical cleaning to maintain membrane permeability was also required by all three systems. The two UF systems used regular chemically enhanced backflushes (CEB) which generated significant volumes of chemical waste for disposal. This was identified as an issue due to the limited routes for waste disposal from the site. Additionally, to prevent discharge of *cryptosporidium* back to the local watercourse, it was decided to investigate methods to concentrate and re-use all dirty backflushing water.

The system offered by *Memcor* was capable of operating at the elevated turbidities experienced at Corfe Mullen and also provided a proven method for treating backflush waste. Additionally, chemical waste volumes were found to be significantly lower than the other systems investigated.

Process design

The new works will use the *Memcor* continuous microfiltration (CMF) membrane system to provide protection against *cryptosporidium.* Six Memcor E108M10C units fitted with 90 M10C modules provide the primary membrane system. There is capacity for 18 additional modules to be fitted to each unit, providing increased plant throughput in the future.

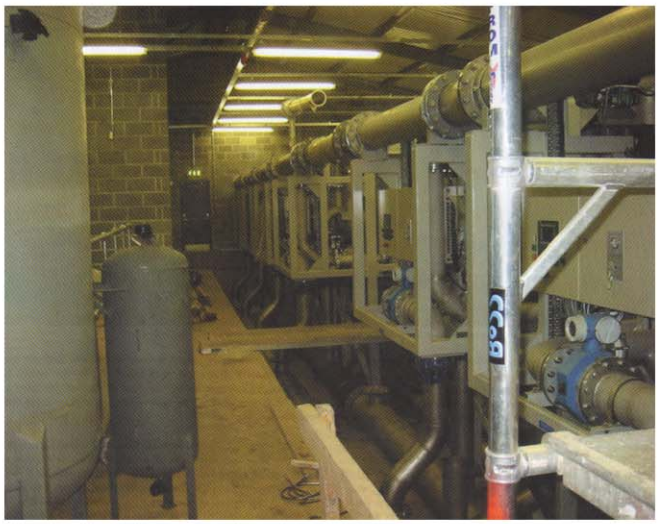
Raw water will be supplied from the existing well and borehole sources to a new raw water balance tank. Variable speed pumps will be used to feed the plant and provide a constant feed pressure for the new primary membrane filters. Two strainers rated at 500 microns will provide protection for the primary membranes. Each primary membrane unit operates at a fixed flow of 207m^3/h. The number of primary membranes required in operation will be controlled by the demand on the existing chlorine contact tank. The filtered water is disinfected using the existing chlorination and de-chlorination equipment before being transferred by re-lift pumps to the supply reservoirs.

The membranes perform regular automatic backwashes, the interval between successive backwashes being determined by the feed water quality. To achieve a zero liquid discharge from site, the dirty backwash water from the primary membranes will be directed to a balance tank and used to supply secondary membranes. Filtered water from the secondary membranes will be returned to the raw water balance tank. There are two *Memcor* 48M10C membrane units operating as the secondary membranes. The dirty backwash water from the secondary membranes will be settled, using a lamella separator, the supernatant being returned to the secondary membrane balancing tank and the sludge stored in two sludge tanks prior to removal from site.

Both sets of membranes will also require periodic cleaning using caustic and acid solutions. Each clean-in-place (CIP) solution will be prepared and maintained at the correct concentration and temperature until required. Caustic CIPs will be performed most frequently with the combination of an acid CIP followed by a caustic CIP being performed after a user defined number of caustic CIPs. The caustic solution is used a number of times whilst the acid solution is only used once. Spent caustic solution will be neutralised prior to transfer to a chemical waste tank for removal from site. Chemical rinse water and the acid solution will be neutralised and returned to the works inlet.

Design and construction

A design and construct contract for the complete works, including membrane equipment, mechanical and electrical and civil and building works was awarded in March 2001, following a competitive tender. Planning permission was obtained in parallel with the tender period. Construction and installation of the mechanical and electrical equipment was substantially complete in March 2002. Commissioning is scheduled to be completed by June 2002.



Total scheme value is approximately £4.0 million.

Project team

Key members of the project team were:

Project Manager: *MWH Wessex Ltd*[1] *(formerly Wessex Water Engineering Services);* Architect: *Race Cottam Associates;* Consultant: *Binnie Black & Veatch;* Main Contractor: *Earth Tech Engineering Ltd;* Membrane Supplier: *Memcor;* Civil sub contractor: *Dean & Dyball.* ■

Note on the authors: *Lisa Staples is Process Engineer and Julian Welbank, Technical Manager, MWH Wessex Ltd* [1]

Note: [1] MWH Wessex Ltd is a joint venture between MWH UK Ltd and Wessex Water Ltd. MWH Wessex is responsible for managing the AMP3 capital programme for Wessex Water Services.