Invercannie WTW

£10.5m membrane plant improves Aberdeen water quality

by

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Invercannie WTW provides the greater part of the water supply for the city of Aberdeen and surrounding area. The works dates from Victorian times, extracting water from the River Dee 30kms upstream of the city and passing treated water along gravity aqueducts into supply. The existing treatment process is slow sand filters, with a more recent upstream ozonation plant. Scottish Water has invested £10.5m in the construction of a large membrane plant downstream of the slow sand filters to alleviate concerns about cryptosporidium and improve the quality of Aberdeen's water supply.

The process chosen is a submerged membrane system developed by *Memcor*. In membrane filtration systems it is normal for the membrane to be in the form of fibres, or fine tubes, the walls of which are the filter media. The submerged system is unusual in that the flow is from the outside inwards through the fibre walls, The membrane fibres ("lumens") are arranged in clusters, suspended in tanks ("cells") and the insides of the lumens are placed under suction by the filtrate pumps.

There are seven primary cells, six are needed for the full designed flow of 70Ml/d and the plant is sized to allow for one cell to be out of service for either automatic cleaning or maintenance. The levels are such that the cells, being below ground, accept flow by gravity from the slow sand filters. The filtrate pumps suck the process water through the membrane and discharge to the aqueduct. Variable speed drives on the filtrate pumps control flow to the set target, taking account of fouling of membranes and any cells being out of service. Dirty backwash water is filtered in two slightly smaller secondary cells, whose filtrate is returned to the membrane plant inlet, and whose waste is pumped back to the head of the treatment works.

The project was proposed in 2002 and agreed in principle by the end of that year. The new plant is built within a disused filter tank inside the existing works boundary and close to the aqueducts.

Pilot plant

A pilot plant was quickly established on site to gather history from as early a date as possible of the performance of the submerged membranes with different characteristics of water. (The nature of water discharging from the slow sand filters changes markedly as the raw river water changes with rainfall and season of the year) This knowledge and experience has proved to be of the greatest importance in developing the regimens of backwash "chemically enhanced backwash" (CEB) and "clean in place" (CIP) which must be followed to ensure the guaranteed performance and operational life of the plant.

Both the CEB and CIP cycles involve the use of concentrated chemicals, bringing about the requirement for elaborate neutralisation systems with corresponding controls and safeguards.

Partnership means success

The project was handled by a partnership team and well demonstrates the advantages to be gained by this type of project delivery system.

Scottish Water, and their predecessor North of Scotland Water, had an established partnering arrangement with contractor *MJ Gleeson* and consultants *MWH*. This mature relationship became the key to delivering the project in a timescale much shorter than would have been possible with conventional contracts.

Contractor and designer already had working relationships with Scottish Water's framework suppliers and other specialist sub contractors. (A particular example is the control systems contractor, whose intimate understanding of SW's requirements and knowledge of the existing site SCADA arrangements would make for a smooth integration of the new system into the old)

Similarly, early involvement in the initial design stages from *Memcor,* who carried out mechanical installation and commissioning of the membrane system, contributed significantly to the speed with which the project was developed.

Speeding the project

This partnering approach through all levels of the supply chain has allowed the duration of the project to be remarkably short. Only 20 months elapsed from conclusion of first stage feasibility studies to the membrane plant entering service. Construction started on site in December 2002, just two months after the project team had selected which of the proposals should be progressed. The membrane building was wind and water tight by May 2003 allowing access for the M & E installation.

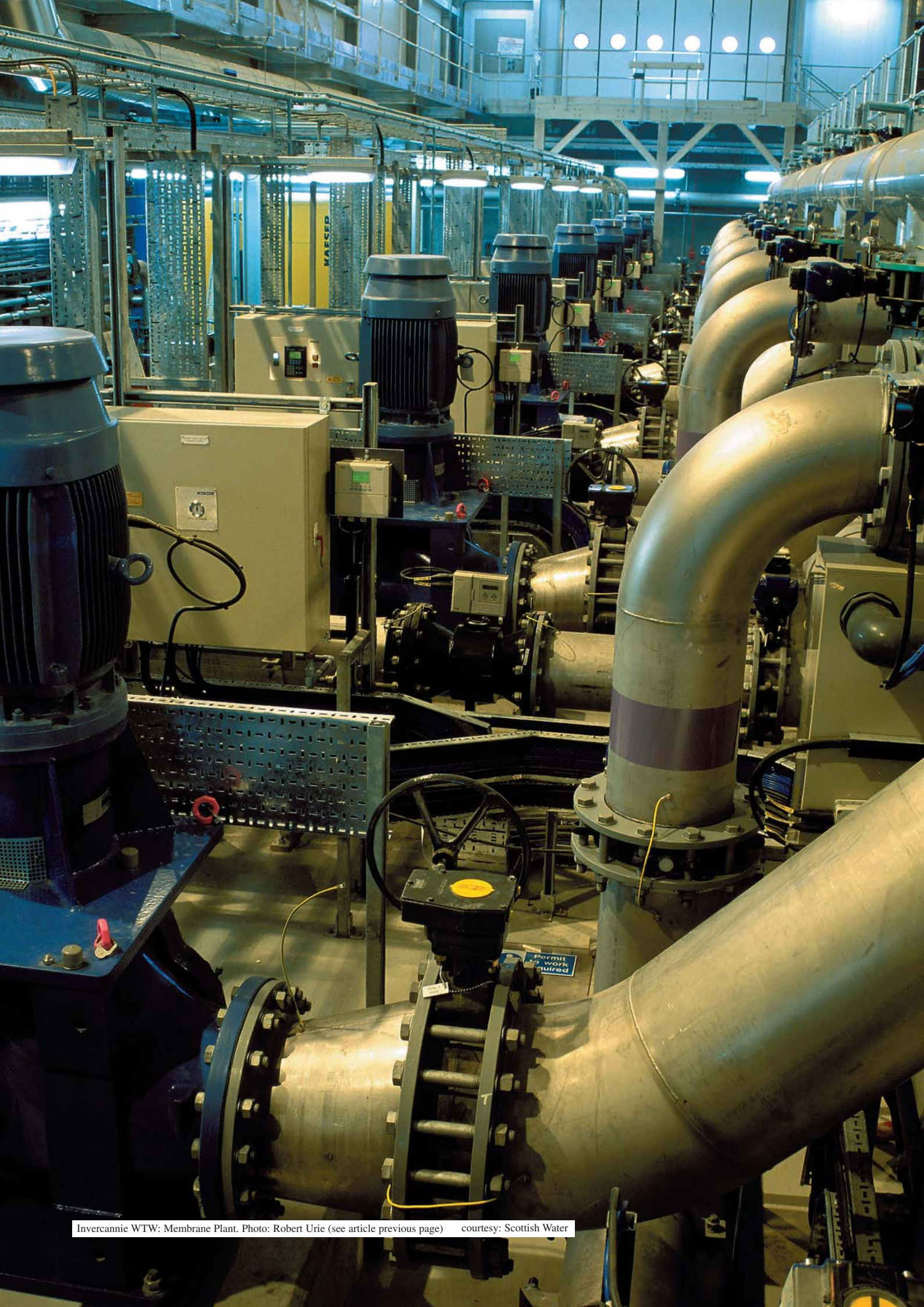
Commissioning of the plant commenced in January 2004 and water to supply date was April 2004.

Client and contractor are in agreement that by fostering a partnership environment, both can reap tangible benefits.It can be demonstrated that the project achieved faster drawing and document approvals, fewer design changes and required less client staff involvement than would be normal to support design and site activities. The result has been a very efficient project delivery mechanism.

Had a more traditional procurement route been adopted, in a normal contractual environment, the overall package would only have been ready for tendering by May 2003. Likely completion date would then have been January or February 2005 ■

Note: *The author of this article, Robert Urie, is an Engineer working with Scottish Water Solutions.*

Invercannie WTW: Membrane Plant. Photo: Robert Urie (see article following pages) courtesy: Scottish Water



Invercannie WTW: Membrane Plant. Photo: Robert Urie (see article previous page) courtesy: Scottish Water