

Kilmelford WTW

£2.2m project improves Highlands water quality

by
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The Kilmelford Water Treatment Works is located in Lorn on the west coast of Scotland approximately 14 miles south of Oban. The existing works treats raw water extracted from Loch a’Phearsain, at the southern end of Gleann Mor, to supply the Kilmelford village areas serving an existing population of just under 100. The project drivers include compliance with the Trihalomethane (THM) standard to meet a PCV of 100µg at consumer tap and disinfection control.



Site preparation at Kilmelford WTW

courtesy of Lagan Construction

The output deliverable is to reduce the Disinfection Index (DI), a new water quality measurement in the Q&Silla Water Quality programme, to a value of under 20 at the works outlet. The DI is intended to define the stability of the chlorine residual leaving the WTW compared to a predefined standard. Improvement to disinfection control and quality monitoring may be required to meet this output deliverable.

However, where existing assets are in place and adequate to meet the requirements these may be utilised.

In addition to the water quality drivers a separate growth driver was also identified for Kilmelford. The project being carried out under Scottish Water’s Q&Silla programme, was tendered under Scottish Water Solutions’ market testing scheme. The final contract was awarded using the NEC3 conditions of contract, Option C on a design and build basis.

Existing works

Kilmelford currently serves a population of around 95 with an average demand of 0.05 MLD and a peak demand of approximately 0.06 MLD with an existing water order of 0.091 MLD.

Under normal operating conditions, the raw water at the intake structure in Loch a’Phearsain is screened before flowing under gravity for approximately 400m and entering the two upward flow sand/GAC filters at the treatment works site.

The raw water initially passes through the integral inlet chambers and associated valve system before passing into each filter. The filtered water is then gravity fed to a clear water storage tank (CWT) with hypochlorite dosing enroute. The existing CWT is a reinforced concrete structure with storage capacity of 68m³, equated to approximately 2 days supply.



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Water treatment building at Kilmelford



courtesy of Lagan Construction

From the CWT, the final water flows by gravity to distribution, passing through a flowmeter at the outlet from the CWT. A final water sample point is also provided on the CWT outlet.

Background

Under the Scottish Water Q&S11 programme, work had been carried out to replace the existing GAC filter media, improve the hypochlorite dosing system and upgrade the existing access track.

A number of different options were investigated including replacing the GAC within the existing filters but this was not considered to provide a robust solution and there would be no guarantee of how long the replacement GAC would last.

The introduction of a new Scottish Water Signature Solution on Adsorption also precluded the use of GAC as a treatment option raw where water colour is over 40 Hazen and the results obtained from a sampling programme showed that Kilmelford lay within this category.

A main out solution was also considered but due to its remote location estimated costs were significantly higher than other options.

The final preferred options were based on nanofiltration technology comprising installation of a new tubular membrane plant on land adjacent to the existing site. The solution also includes further work to convert the existing filter structure to additional clear water tanks.

A new building to house the membrane plant and welfare facilities is to be provided along with a chemical spill tank, process pipework and associated valves and fittings. The PMP 1 B 90 package membrane plant will be located within a new building and will incorporate a new hypochlorite dosing and control system. The membrane technology is based on the use of tubular membrane elements consisting of a single ply non-woven substrate tube coated with a cellulose acetate membrane layer. It is supplied by PCI Membranes and the module type is PCI CA202. The membrane is designed for use in treating unchlorinated coloured water. It is used in conjunction with PCI's plastic C10 module. The C10 module consists of a housing containing a bundle of 72 perforated ABS tubes. The membranes are inserted into these tubes. Viton™ rubber tubes seals the membranes into the tubes and then the tubes are connected by U bends plugged into the tubes seals. This provides a continuous hydraulic path through all 72 tubes in series.

Modules are usually mounted in parallel in arrays called stacks. For each stack, pipework is provided to distribute fluid to the modules and

collect concentrate and permeate from the modules. Plants are designed such that a proportion of the retentate is recirculated to the modules inlet to maintain the required cross flow velocity. The treated water (permeate) from the individual modules is piped to a common manifold and then passes to the downstream treatment stages.

Raw water will initially be pumped through a 2mm basket strainer at the works intake and then through the membranes. The filtered water is disinfected with sodium hypochlorite and neutralised on limestone by a pressurised neutralite filter. The neutralite filter backwash tank is filled via a dedicated line from the membrane permeate pipework. Outside the 20 hours production operation, when a backwash is required, the membrane plant is started as normal production operation, but the permeate is diverted to the backwash tank. The neutralite filter backwash is initiated on a time basis, after the 20 hours daily production period and 7 days operation.

Further equipment includes backwash pumps and blowers for the neutralite filters, membrane feed pumps and recirculation pumps are arranged as duty/standby equipment. The works will also provide a new telemetry system.

The membrane plant is one of several being installed in the north of Scotland which utilise one of four standard designs (from 35m³/day to 600m³/day) developed by Scottish Water, SWS and Veolia Water Systems. The project at Kilmelford utilises a scaled down version of the standard 150m³/day tubular membrane plant. The adoption of this approach at the works will permit future expansion of the works by addition of further membrane stacks.

Project issues

The use of the membrane solution requires additional raw water and as a result the project is one of the first to undergo an amendment to the CAR licence conditions (which supersede the previous Water Orders).

A number of wildlife surveys have been carried out to establish whether development licenses were necessary and identify any mitigation measures if necessary. During one such survey it was discovered that an otter holt is located in close proximity to the site.

The Kilmelford project is being carried out in partnership with Lagan Construction (Charles Brand/EPS Environmental). The project began in April and is due for acceptance in November 2008.

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