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CASE HISTORY

FORT WILLIAM

End User	Scottish Water
Process	Abstraction from Wells, and sterilisation
Application	Treatment of River Water

Close up of Cascade Aerators

Contact Tanks

Introduction

ACWA built Scottish Water's Fort William Area Water Supply Scheme—an M&E project in which ACWA was responsible for the process design, supply, installation, testing and commissioning of all process systems, at the wellfield water treatment works and service reservoirs.

Plant Description

When considering the projected population growth for the area Scottish Water recognised that the existing water supply structure at Fort William was inadequate. It was established that a new treatment works would be required and it was decided that abstraction of raw water from a proposed wellfield site adjacent to the river Lochy would be the most preferable option.

The new WTW was capable of continuously handling and achieving specified quality criteria for a range of raw water flows between 50 l/s (equivalent to 4.3 Ml/d) to 139 l/s (equivalent to 12Ml/d). The works comprises 7 operational boreholes with wellhead pumping stations, flow control, cascade aeration, orthophosphate dosing, disinfection (chloramination), pH correction and pumping stations (to the reservoirs at Camisky and Spean Bridge).

Wellfield

Because of seasonal flood conditions, the seven electro-submersible pumping sets, associated head-works and control systems were designed to operate continuously without interruption, damage or operator intervention in partially submerged conditions.

Each of the seven boreholes incorporates a pressure transducer to monitor water levels and inhibit/enable the pump. Water pumped from the boreholes is conveyed to the inlet of the new WTW by seven dedicated rising mains.

Flow Control

At the new water treatment works, all seven rising-mains enter a flow control chamber where dedicated electromagnetic flow measure individual flows. A valve installed before each flow meter enables flow rates from the boreholes to be adjusted individually. Readings from the flowmeters are transmitted to the plant's PLC for control purposes and displayed on the operator's HMI control panel.

After the flow control chamber, individual flows combine in a single pipeline to feed the cascade aerator. A sample line taken from the combined line is monitored for turbidity and the 'turbidity high-high' signal used as a regulatory alarm to comply with the Scottish Executive Cryptosporidium Directive.

Cascade Aeration

The feed pipeline to the cascade aerator divides into two streams, each feeding one of the two inlet chambers. The water is aerated naturally—entraining oxygen from the atmosphere as it flows over a three—step system to achieve 75% oxygen saturation.

The aerated water leaving both sides of the cascade aerator is combined in a single pipeline and disinfected with sodium hypochlorite before passing through a static mixer. The chlorinated water is dosed with sodium orthophosphate to reduce plumbo solvency.

Contact Tank, Rapid Mixing and Pumping Station

The chlorinated water enters the base of the contact tank, which is divided into two equal sides fitted with internal baffles to direct the flow and eliminate short-circuiting of water across the tank. Contacted water from each side of the tank exits the system and combines in the first chamber of a rapid mixer tank.

The contacted water overflows a weir into the second chamber of the mixing tank where it is dosed with a lime solution to correct the pH and Ammonium Sulphate to convert the chlorine to chloramines. An impeller mixer is installed in the second chamber to ensure complete mixing of the chemicals. Treated water overflows a final weir in the mixing tank and enters one of two pumping station wet wells, where three centrifugal pumps operating as duty/duty assist/standby transfer it to the service reservoir.

Service Reservoirs

Treated water for the local consumer mains supply system is stored in two service reservoirs constructed at nearby Camisky and Spean Bridge.

Chemical Storage and Dosing

Sodium Hypochlorite, Sodium Orthophosphate and Ammonium Sulphate are held in dedicated storage tanks periodically filled from IBCs via filling points on the outside of the building. Each storage system utilises two air operated diaphragm pumps to transfer chemicals from the bulk tanks to dedicated day tanks.

Hypochlorite, Sodium Orthophosphate and Ammonium Sulphate are dosed from dedicated day storage tanks by two dedicated dosing pumps.

pH Correction

For pH correction, the lime solution is prepared in two make-up tanks, each with a dedicated dosing pump, ultrasonic level transmitter and conductivity level probe. The lime solution dosing is flow proportional, based on combined flow-rates from all the boreholes—with residual control based on a pH monitor installed downstream of the dosing point.

Powdered lime delivered to the treatment site is stored in a 22 tonnes duty silo located in the process basement. The silo is fitted with a vibrator and aeration pads to ensure the smooth movement of lime into the system. The lime powder is discharged to each make-up tank by dedicated screw conveyors and accurately measured by load cells in each hopper.