

# Axbridge 30 Mld Pre-Treatment Plant

## removing nutrients from river water for reservoir recharge

by  
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The existing works, located south east of Axbridge village and adjacent to the northern embankment of Cheddar Reservoir, comprises the pumping station to deliver reservoir supply to the local water treatment plant at Cheddar. During the dry summer of 2003 when water levels within the reservoir fell significantly, Bristol Water constructed an emergency sedimentation plant at Axbridge in order to reduce pressure on regional raw water resources by safely enabling the discharge of water from the River Axe into Cheddar Reservoir. Bristol Water is licensed to abstract up to 30 Mld between 1st of November and 30th April each year. This water is used to support Cheddar Reservoir, and as such forms part of the overall Company supply/demand balance; being also an important part of their drought contingency plan.



Axbridge: View of completed Actiflo® Pre-Treatment plant (plant building in foreground)

photo courtesy of Veolia Water Solutions & Technologies

This emergency plant saw little service, and as part of their AMP4 programme a permanent pre-treatment system was required, the process objective being to remove turbidity, colour and nutrients (nitrates and phosphates) from the river source; the latter as a result of fertiliser use in the catchment. Without such removal, and particularly that of phosphate, algal blooms could be expected during the following summer period if water were abstracted at the maximum allowable rate throughout the winter, which would effectively double the phosphate load in Cheddar Reservoir.

### Process solution

The VWS technical solution centres upon the Actiflo® process, which is ideally suited for difficult-to-treat sources such as highly turbid or flashy river water. Actiflo® is a patented extremely versatile, high-rate, sand ballasted clarification system that effectively removes suspended solids present in surface water by

coagulation/flocculation and lamella settling, achieving extremely low levels of outlet turbidity. Microsand (known as Actisand®) is utilised as a seed for floc formation, providing surface area that enhances flocculation and acts as a ballast or weight. The resulting sand ballasted floc enables clarifier designs with high rise rates and short retention times, having a typical footprint between 5 and 20 times smaller than conventional clarification systems of a similar capacity.

At Axbridge, a low footprint was critical in order that the new pre-treatment system could be sited upon the original foundation of the emergency sedimentation plant. Further, given the intention by Bristol Water to only operate the plant according to actual need during their annual abstraction window, of equal significance in plant selection was the high degree of operational flexibility afforded by the Actiflo® process including rapid start up and shut down.



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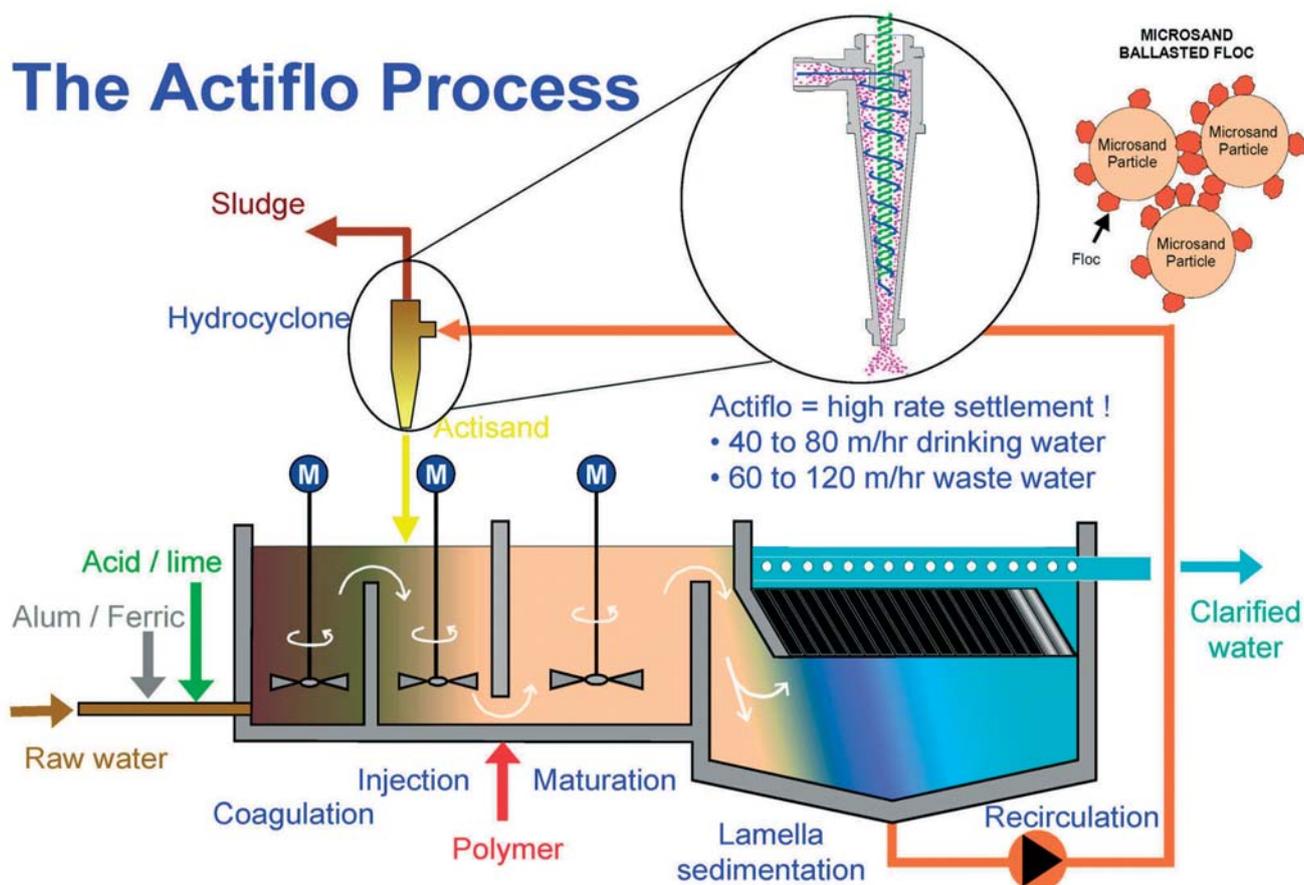
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# The Actiflo Process



Picture above: General schematic of Actiflo® process.

courtesy of Veolia Water Solutions & Technologies

Parameter	Design Basis	Current Operational Data
Flow	30MLD	22.5MLD
<b>Raw Water:</b>		
Turbidity	< 72.2 NTU	
Phosphate	< 965 µg/l as PO4 (483µg/l as 95%ile)	360 – 1090 µg/l as PO4
Colour	< 45.5 Hazen	18 – 62 Hazen
<b>Treated Water:</b>		
Turbidity	< 2NTU (95%ile)	0.9 – 1.9NTU
Phosphate	50 µg/l as PO4 (95%ile)	10 – 50 µg/l as PO4
Colour	< 10.0 Hazen	5 – 10 Hazen
<b>Thickened sludge</b>	> 4% ds (95%ile)	Min 4%
<b>Sludge Cake</b>	> 18% ds (95%ile)	Min 18%

Table showing performance targets

courtesy of Veolia Water Solutions & Technologies

As a suitable treatment technology Actiflo® is well proven with over 450 references worldwide (15 within the UK), many of which operate with similar raw water characteristics and purpose as Axbridge.

## Project Implementation

Bristol Water's Inception Report for this project at the end of 2005 identified the VWS Actiflo® 'enhanced coagulation' process as the most efficient means of removing the majority of the phosphate and turbidity from the abstracted River Axe water.

During 2006, VWS worked closely with Bristol Water, their Amp 4 Framework Partner *Costain PLC* and *Designer Black and Veatch*, to prepare a detail design/programme for implementing the project by the end of the Abstraction period in April 2008.

The wider project scope includes off site works at the River intake station; new inlet screens (6mm escalator) have been fitted together with replacement pumps and associate controls. The 30MLD pre-treatment plant comprises 4 No fabricated package stainless steel AS4 Actiflo's, operating as duty units rated at 7.5MLD per. 96% sulphuric acid is dosed for pH correction, and PACl added as coagulant upstream of an inlet blending tank. Anionic polymer is dosed as a flocculant aid within the Actiflo® plant and the Actisand® is automatically added under batch delivery from a storage silo.

Sludge is continuously discharged from the Actiflo® process and, facilitated by polymer addition, is thickened within a WRC Thickener. Supernatant is recovered and recycled to the inlet

blending tank. Following short term storage, thickened sludge is dewatered within duty/standby belt presses with cake being skipped prior to off site disposal.

Treated water is pumped into the reservoir via new dry mounted centrifugal pumps, and press filtrate liquor is transferred via a dedicated submersible pump station to the local public sewer in Cheddar. Since the existing water pumping station is not manned, the new Actiflo® system has been designed for non-attended auto operation, with weekly visiting attendance only from Bristol Water staff.

**Project Status & Process Operation**

The project awarded at the start of 2007, was constructed by the end of the year and pre-commissioning started early 2008. Process commissioning has been ongoing since early February and at the time of writing optimisation continues though analytical trends to date have shown the plant capable of achieving compliance with its various quality determinands. The formal Take-over Tests are scheduled to commence early April with a view to complete by end of April concurrent with closure of the winter abstraction window.

The project team comprised; Bristol Water, their AMP4 Framework Partner Costain PLC, who project managed the scheme and undertook the civil works and the key pumping stations. Black & Veatch as Costain's Designer and VWS as the specialist Process Contractor responsible for design and construction of the water and sludge unit processes.

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