

# Lower Carno Dam Remediation

## B&V demonstrates the effectiveness of a fully integrated consulting and construction business

by  
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**L**ower Carno Dam, in Ebbw Vale Blaenau Gwent, has been beset by leakage problems since its construction in 1911 and the series of remedial measures put in place over the years has had limited and temporary success. The combination of increasingly severe leakage in 2005 and the evidence of substantial settlement of the dam resulted in the urgent drawdown and decommissioning of the reservoir.



*Lower Carno Dam remediation work underway*

*Courtesy of Dwr Cymru Welsh Water*

As principle contractors for Dwr Cymru Welsh Water (Welsh Water), under its Asset Management Alliance (AMA), Black & Veatch (B&V) were engaged along with CDMc, which undertook the design and construction of the £4.8m remediation scheme of the Lower Carno Dam. The project involved specialist ground engineering techniques, to reduce leakage in a 180m long and 27m high earthfill dam, on the border of the Brecon Beacons National Park.

B&V provides the services of panel engineers (appointed under the Reservoirs Act 1975) for safety inspections of many of Welsh Water's 71 operational reservoirs and was already engaged as the process partner of the AMA. This scheme provided the perfect opportunity for the global engineering, consulting and construction company to demonstrate the effectiveness of the fully integrated resources available to clients from its European water business. Civil

engineering construction management professionals joined forces with existing design teams in Wales and the dams and geotechnical experts in B&V's Redhill office, to take on this challenging and environmentally sensitive scheme.

B&V investigated the cause of the leakage and provided an options report for DCWW. The firm has subsequently been appointed to design the remedial works and to undertake the remediation. Construction started on site in January 2008 and was completed in March 2009.

The B&V design incorporates a 40m-deep bentonite slurry wall to replace the centre of the clay core, a 10m deep grout curtain in the rock foundation, with contact grouting between the two, contact grouting around the scour pipe culvert and spillway structures and radial grouting arrays from within the culvert. Installation was by

Specialist contractor, Bachy Soletanche (Bachy), which also helped to develop the detailed design. Bachy's highly experienced site team and state of the art equipment and computer technology ensured the highest level of accuracy and quality control and minimised the risks of any outbreak of slurry or grout. Enabling works and reinstatement was done by the AMA civils partner along with various civil modifications and remedial works.

Risk management played a central role in this project from the outset. Great care was taken to ensure appropriate conditions of contract and method of measurement, along with detailed allocation of commercial and physical risks. Many risks had been identified and regular early warning meetings and risk reviews with the client and subcontractors, ensured that mitigation and financial compensation were properly managed.

The local hydrology, interaction with the Upper Carno compensation flows to the down stream river course, underground cave systems and dam leak paths, all combined to make potential water pollution a

complex and difficult issue to manage. Detailed environmental pollution control measures, monitoring systems and emergency response plans were in place and the B&V project and site management team worked closely with Environment Agency Wales throughout.

The confined space grouting works from within the culvert were difficult, with very limited working space and tricky 3D control of the complex drilling arrays. A lesser Horseshoe Bat had to be moved temporarily, under government licence, to allow the works to proceed. The dam is situated in a residential area and many of the locals use the area around the reservoir for walking. Comprehensive liaison with the local community ensured that residents were kept up to date with the scheme and were aware of any health and safety issues. Safe access routes were provided for the public and construction traffic was managed accordingly.

**Note: The Editor & Publishers thanks Nick Howell, Black & Veatch Project Manager for providing the above article.■**



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