MINEWATER SPECIAL

Four years of planning, construction and testing work have led to a cost effective solution designed to prevent predicted pollution of the River Coquet and the Hazon Burn.

Whittle Goes Live

The minewater treatment scheme at Whittle in Northumberland, designed to prevent future pollution of the Hazon Burn and the River Coquet became fully operational in early July 2002. The scheme is the result of four years' planning, construction and testing work, with the Authority working closely with project partners to establish a sustainable and cost effective solution.

The likelihood of serious pollution of the River Coquet was raised in early 1998 following the closure of Whittle Colliery. The concern was particularly acute since the Coquet is a Site of Special Scientific Interest as well as providing one of the region's major sources of public water supply.

A number of monitoring boreholes into the workings had already been drilled by the Environment Agency to enable the rising minewater across the whole of the Colliery workings to be monitored. Initially the rate of rise of water in the workings was of the order of 9cm per day, indicating that urgent action would be necessary if a catastrophic polluting event was to be avoided.

Experience of minewater recovery in other mines suggested that this rate would probably decline, but this was by no means certain and preparations had to be commenced to implement an early solution. Consultants Entec were appointed to advise on the hydrogeology and to design the treatment system.

In order to design an effective minewater scheme, it is essential to know the quantity and quality of water to be treated. In this case the only data available at the start of this project was from when the mine was working. The quantity of 5,000m^3 per day was likely to represent an absolute maximum in an abandoned situation and was used for the design criteria. However, the quality was still to be determined. The iron concentration in the pumped waters when the mine was working

was around 4 mg/l, but sampling from one of the boreholes was as high as 900 mg/l.

In order to try and establish a more reliable water quality figure, two boreholes were used with water being pumped out of the workings, sampled, and then discharged back into the workings. The boreholes were sufficiently far apart to avoid recirculation. The test was carried out over a period of 6 weeks, and as well as providing better data on water quality, treatability tests were also carried out to assist with the design of the scheme. After a few days the water quality stabilised at 42 mg/l iron, 2.4 mg/l manganese and was net alkaline with a pH of around 7.

These results indicated that the iron could be removed passively with a system consisting of aeration cascade, settlement lagoons and polishing wetlands. Manganese is more difficult to remove and it was possible that an active system may be necessary, although these are expensive in terms of both capital and revenue costs. Having considered the limited removal of manganese by the passive treatment system, and dilution offered by the flows in the Coquet, it was considered that additional treatment for manganese may prove unnecessary. However, this could only be established over time by practical tests.

Construction of the treatment system commenced in June 2000 consisting of an aeration cascade, two settlement lagoons and three reedbed cells designed to terrace down the slope of the site to complement the surrounding landscape.

A full scale stepped pump test was commenced in January 2002 where pumping was carried out at varying rates from 10 l/s to 40 l/s to test the efficiency of the treatment system, and the ability to control underground water levels at the various rates.

Newcastle University staff played a key role in monitoring the efficiency of the treatment system, and close daily liaison with the Environment Agency and Northumbrian Water was essential throughout to ensure the stringent standards at the nearby Warkworth abstraction point were met.

The system quickly demonstrated that it was capable of treating the iron to less than the target figure of 1 mg/l with a removal rate of over 95%. Manganese removal was less pronounced although the test did confirm that the flows in the Coquet diluted the manganese to such a degree that the requirements of Northumbrian Water were met.

The rate of rise of the underground water had reduced to less than 3cm/day and monitoring at the various boreholes into the workings demonstrated that water levels could be controlled at a pumping rate of around 15 l/s. It was subsequently agreed that full-time pumping should be commenced at this rate in early July 2002 and this has so far been successful.

The reedbeds have now matured and are proving more efficient in removing manganese with the concentration being lowered from 1.6 mg/l to 0.2 mg/l. This ensures that the requirements at Warkworth can be comfortably met.

The stepped approach to the project is considered a success in delivering a cost effective solution to the predicted pollution of the River Coquet since it has avoided the need for costly active manganese treatment which could have been viewed as essential based on early information.