

# Lamesley Combined Water Treatment Scheme

## first wetland to co-treat minewater and final effluent

by Karen Welsh BSc

**N**orthumbrian Water and the Coal Authority are working together to significantly improve the quality of the River Team by collaborating on the development of an eight-hectare wetland at Lamesley. The passive treatment of the two discharges in an aerobic wetland is a unique and sustainable option generating a substantial area which will create an enhanced bio-diverse habitat for the betterment of the local environment, as well as offering economical advantages in terms of land requirements, and enhanced pollutant removal.



Lamesley: Aerial view showing reed bed area

*Courtesy: Northumbrian Water*

### The purpose

The River Team is an urban river that flows generally northwards from Stanley in County Durham and is a tributary to the River Tyne at Gateshead. Until recently, the Team was one of the most polluted rivers in Britain, and despite improvements to water quality in recent times, some areas of the catchment remain polluted and of low ecological value. The Environment Agency (EA) currently grades the River Team as Class D on its General Quality Assessment.

Two of the main discharges to the Team, comprising some 40% of flows in the river in dry weather conditions, are a controlled mine water discharge from Kibblesworth and the final effluent from Birtley STW. Both effluents currently discharge into the Team through separate outfalls approximately 200 metres apart.

Discharge from the 28,000 pe works at Birtley receives secondary treatment. At DWF the flow is 100 l/s, increasing to 300 l/s at peak flows. Northumbrian Water had obligations to improve the discharge to meet a consent of 50:15:5 (SS:BOD:NH<sub>4</sub>), from the current standard of 50:50 (SS:BOD) under the National Environmental Programme. This work had to be completed by 31st March 2005 and was identified to require the construction of four nitrifying filters.

The Coal Authority discharges minewater pumped from abandoned mine-workings in the Durham coalfields. Pumped to the surface at Kibblesworth, the minewater discharge of 340 l/s flows into the Team via a gravity main along the course of the old Bowes railway line. The Coal Authority and the EA have a joint aim to enhance the environment by reducing pollution of controlled minewater discharges, although there were no formal dates for this particular site. However, improving the quality of the discharge from the former Kibblesworth mine would help achieve the Environmental Quality Standard for dissolved iron in the River Team. Had the Coal Authority carried out this work in isolation, this was most likely to have been achieved by the construction of a reedbed treatment system.

### The Partnership

Although both parties could have constructed suitable treatment systems on their own, both were key stakeholders in the River Team Revival Project, a partnership initiative supported by the European Regional Development Fund (ERDF). The EA were also stakeholders in this Project. Formed in 1999, the River Team Revival Project involves local communities and key stakeholders in developing plans to provide sustainable environmental improvements to the catchment.

It was this initiative, as well as the close proximity of the two discharges, that led to the consideration that both discharges could be treated together using passive treatment in an aerobic wetland.

To prove this theory, Newcastle University was commissioned to carry out a desk study in April 2002. The study concluded that the proposed combined treatment system would have many advantages over separate treatment of the discharges, including utilising the oxygenated nature of the minewater for the promotion of ammonia nitrification. In addition, phosphate, which is generally difficult to remove using either active or passive treatment would be removed in the co-treatment process. The report also indicated that the area required for the combined wetland was similar to that required for each discharge on its own, an attractive option from both land purchase and overall financial perspective.

A Memorandum of Agreement was drawn up between Northumbrian Water, the Coal Authority and the EA. This was written to provide a formal foundation for the development of a mutually beneficial environmentally sustainable project while still meeting the water quality objectives of the River Team.

The EA involvement in the Memorandum ensured the project was delivered alongside an appropriate consenting arrangement. For the project to be able to proceed, the combined treatment facility would require a unique consenting arrangement, whereby the parties were consented to discharge into the reedbed rather than the river, with a further combined discharge consent from reedbed to river.

### Pilot Scale Trial

To enable the EA to have the confidence that combining the discharges would provide the improvements required, and provide appropriate design criteria for the full scale wetland a hundredth scale pilot reedbed was constructed in the grounds of Birtley STW in July 2003. This was fed with treated effluent at the rate of 1 l/s and minewater at a rate of 3 l/s. The ratio being that of the mine water and DWF of the STW in normal conditions. Samples were taken daily for ten weeks and then weekly for the next 8 months. The removal rates of key contaminants, namely iron and ammonia were demonstrated to be sufficient to meet the EA criteria of <1mg/l of iron and <3.5 mg/l ammonia in the combined treated discharge to the River Team. Phosphorus, BOD, Nitrate and suspended solids were also removed as anticipated.

### Final design

The Coal Authority commissioned their framework consultants Atkins to carry out design of the full-scale wetland in December 2003.

The final design consists of 9 reed bed cells with a total area of reed bed of 5.6 hectare. The site is split by the Bowes footpath, a public right of way. Four of the cells are to the north of the footpath; the other five to the south, creating two treatment streams.

The minewater flows gravitate to the site via the existing Coal Authority main. The STW final effluent is pumped to the mixing chamber through a new rising main. Once the flows are mixed a splitting chamber directs the flows through pipes to the wetlands on

either side of the Bowes footpath. 300mm pipes then distribute the flows to the inlets of the four reed bed cells, two to the north and two to the south of the Bowes.

Aeration of the mixed effluents is achieved by changes in the level between each set of reed beds, the flow being transferred over cascades at each level change. There are two outfall structures, one each side of the Bowes to discharge treated effluent into the River Team.

A combination of two types of reed were specified for planting in the cells in the ratio of 80% phragmites australis (reed) and 20% typha latifolia (cattail). Although the Coal Authority favour a mix of reeds as specified in this case, the predominant reed is normally typha as historically this was deemed to be the most satisfactory reed type for treating minewater. The Planning Department at Gateshead Council, Durham Wildlife Trust and Northumbrian Water's own Environment Department requested that this reed mix was changed to favour phragmites. This type of reed is native to this area and agreed to be the more desirable habitat in line with the Biodiversity Action Plan for the area. After consultation with Newcastle University, the request was accepted as there was deemed to be no technical reason for using one particular reed type over another.

To further increase the habitat value there are small areas of open water around the perimeter of the cells as well as areas of marginal planting. Raised viewing areas are also provided on the Bowes footpath, to enable unrestricted views across the site.

### Construction

The contract to construct the wetland was awarded to *Byzack UK Ltd* in August 2004. The form of contract chosen was ECC Option C. This work is being undertaken concurrently by *Byzack* with a contract to refurbish Birtley STW to ensure the final effluent meets the consent into the reedbed. This work, designed by *Entec UK Ltd* includes the rising main and pumping station to supply effluent to the reed bed.

Major construction works are programmed for completion by the end of March 2005. Reed planting is programmed to start in May 2005. The delay is based on the Coal Authority experience whereby planting reeds earlier than this has led to the reeds not growing well and in some cases large numbers failing and having to be replaced. Planting work is expected to take 10-12 weeks. Flows were due to be turned on at the beginning of July

### Conclusions

The water quality of the River Team would have been improved by Northumbrian Water and the Coal Authority carrying out their projects in the normal way, in isolation to each other. However, working together in a solution to this issue has led to a sustainable solution that, in addition to generating financial benefits to both parties, will provide wider landscape and biodiversity benefits and improve the opportunities for local people to interact with the natural environment. ■

**Note:** The author, Karen Welsh, wishes to thank the Coal Authority, Newcastle University and Atkins for their contributions to this article.



Lamesley: reed beds

*courtesy: Northumbrian Water*