

Phoslock Europe Newsletter

Spring 2014

Phoslock - the best in situ solution for the remediation of eutrophied lakes and reduction of blue green algae

Rescuing an alpine lake in Austria



The first Phoslock application in Austria took place last year at the Reither See, a small alpine lake near the city of Innsbruck. The application, which is described on Page 2, was aimed at preventing the emergence of unsightly mats of filamentous algae, which had frequently covered the surface of the lake during the bathing season.



Lake Rauwbraken – 6 years after “Flock & Lock”

The first “Flock & Lock” application in the world took place on a popular recreational lake in the Netherlands, Lake Rauwbraken, in April 2008. The treatment was an initiative of researchers from the University of Wageningen’s Aquatic Ecology

Department. Some of the key results from the project have now been published in an article in Water Research by scientists monitoring the ecological development of the lake for the past 6 years. An overview of the paper is presented on Page 4.



Phosphorus reduction in German wastewater streams

New and innovative uses of Phoslock are being developed in Germany, where the product is marketed under the trade name Bentophos. One new use of the product that was recently trialed by one of Germany’s largest

corporations involved the application of Bentophos (German name for Phoslock) to three ponds associated with an in-house sewage treatment system. A summary of the project is given on Page 3.



News from overseas

Australia

Since Phoslock was developed in Western Australia in the nineties, the number of WA applications has grown. On Page 5 we cover a recent application to the Perth’s Ellen Brook by the Swan River Trust.



In brief

A Phoslock European Application Team has received a bravery award from the London Metropolitan Police for assisting in saving a vulnerable man’s life during an application in London’s Kensington Garden. Details on Pages 2-3.

Reither See, Austria

Phoslock helps alpine lake in Austria



The Reither See is a 1.5 ha recreational lake located in Alpbachtal, near the city of Innsbruck in Austria. In recent years, the lake has experienced problems with large, unsightly mats of floating algae which cover parts of the surface during the summer months. As the lake is popular for swimming, fishing and boating, the formation of these mats severely limits the recreational use of the lake. Although average phosphorus concentrations in the water column remain relatively low throughout

the year, the benthic algae species present in the lake are able to grow by utilizing the combination of both high concentrations of phosphate that occur in the sediment pore water, as well as light which penetrates to the lake's depths as a result of the clear alpine water. As they grow, these algae form mats and are carried to the surface of the lake by bubbles of oxygen formed within the mats as a result of algal photosynthesis. In spring 2013, the local municipality chose to apply Phoslock in an effort to limit the ability of the benthic algae to draw phosphate from the sediment pore water. The treatment was undertaken by Bentophos GmbH on 16 May 2013. Prior to the application of Phoslock, the floating algal mats that were already present on the lake's surface were manually removed. Since the application, the amount of floating algae mats has been reduced, clearly indicating that the

application of Phoslock had successfully limited the supply of sediment phosphate to the benthic algal community. An increase in macrophyte growth has also been observed, suggesting that the macrophytes were successfully able to outcompete benthic algae in the lake for the first time in many years. The lake was intensively monitored before and after the application by the consultancy, ARGE Limnologie. Their results have been published and confirm the positive effects of the Phoslock application on the development of the lake during the bathing season.



Phoslock application team recognized for bravery



Phoslock was recognized for more than its ability to reduce phosphate concentrations in water recently when a Phoslock Europe application team received a commendation for outstanding bravery from the London

Metropolitan Police (LMP). The award was in recognition of assistance given to the Royal Parks Operational Command Unit of the LMP by the application team during a Phoslock application on Round Pond in Kensington Gardens in London in February 2012.

The application team assisted the police by alerting them to and subsequently aiding in the rescue of a vulnerable man who had attempted to commit suicide by jumping into the pond. The joint actions of the application team and

the LMP led to the saving of the man's life.

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Photos courtesy of the London Metropolitan Police

Sewage Treatment

Phosphorus reduction in German wastewater streams

One new use of Bentophos (German tradename for Phoslock) that was recently trialled by one of Germany's largest corporations involved the application of the product to three ponds associated with an in-house sewage treatment system. Each of the ponds are used as settling ponds, with treated water from the plant passing successively through each pond before being discharged to groundwater through a soakaway unit composed of gravel and sand. Total phosphorus (TP) concentrations in the final effluent water are required by law to be less than 3 mg/L before the effluent may be discharged to groundwater. Although the TP concentrations are reduced by the treatment system,

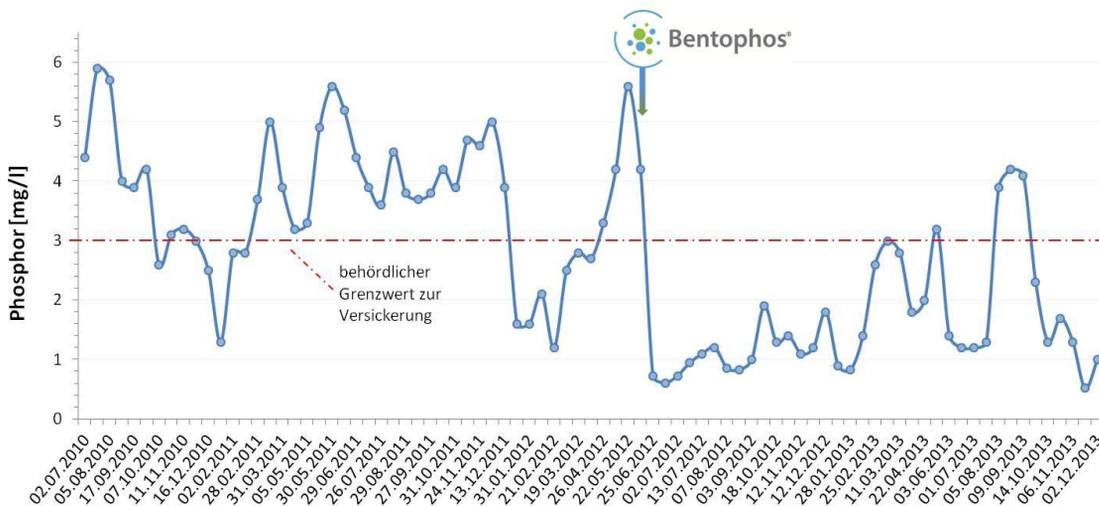
the effluent exiting the ponds generally exceeds this limit as a result of phosphorus release from the sediments, a problem that occurs particularly frequently in summer.

In an effort to lower TP concentrations in the final effluent and comply with discharge limits, the corporation engaged Phoslock licensee for Germany, Bentophos GmbH, to apply Bentophos to the ponds. The application was undertaken in July 2012 and one tonne of Bentophos was added to each of the three ponds (which had water volumes ranging between 1300 m³ and 2100 m³).

The graph below shows the reduction in TP that was observed

following the application. Although phosphorus levels in the ponds began to increase again after the application due to the continuous inflow of nutrients into the ponds, the Bentophos application allowed the corporation to comply with discharge limits for phosphorus for 13 months after the application. This period of compliance could be easily extended by undertaking reapplications of Bentophos once TP levels approach the discharge limits again.

The project demonstrated that Bentophos (Phoslock) has the potential to be a cost effective and easy to implement solution in some wastewater treatment situations.



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The Phoslock application team consisted of Andrew Winks, Tiago Ferreira, Nicolai Nowak and Nigel Traill with the award being accepted on behalf of the team by Nigel Traill at a ceremony honouring acts of

bravery by members of the Royal Parks Operational Command Unit at London's Victory Service Club on 15 November 2013.

The awards and commendations were presented by HRH Prince

Michael of Kent, Viscount Jan Simon and the Lord Mayor of Westminster, Sarah Richardson.

Photos courtesy of the London Metropolitan Police

Review Lake Rauwbraken

Lake Rauwbraken is located near Tilburg in the south of the Netherlands. It is a manmade recreational lake (with a sand bottom), which is popular among swimmers and divers (www.rauwbraken.nl). The surface area of the lake is 2.6 hectares, with an average depth of 5 m and a total water volume of approximately 200,000 m³. It is surrounded by trees, agricultural fields and an urbanised area to the east.

In 2008 the lake was treated with a combination of Phoslock (18 tonnes) and a flocculant (2 tonnes PAC39 with 75 kg of Ca(OH)₂ buffer) in order to reduce the phosphorus in the lake and prevent the recurrent blooms of cyanobacteria (Figure 1). The application was an initiative of the

Aquatic Ecology Department of the University of Wageningen (WUR). The lake was intensively monitored by WUR both before and after the treatment.

Chemical and physical data were collected with some of the data being presented in a journal paper by Lurling, M. & van Oosterhout, F., in *Water Research* (2013). This paper summarises the TP and chlorophyll-a concentrations taken over the duration of the monitoring period. The data show a durable temporal reduction in Lake Rauwbraken since the application in 2008 (Figures 2 & 3).

The combination of Phoslock® and the flocculant (known as “Flock and Lock”) resulted in a rapid reduction of TP in the water column as both ortho

phosphate and particulate phosphorus settled on the sediment. TP concentrations remained low (generally below the detection limit of 0.01 mg PO₄-P/L) at all depths for the monitored period of 4 years after the application despite high inputs of phosphorus from groundwater in autumn and winter (Figure 2). Although the daphnia population decreased immediately after the application, presumably due to starvation from reduced phosphate in the water column, no long term negative effects have been observed on either zoo-plankton or macrofauna. Greater numbers of juvenile tench have also been observed, probably due to the improved shelter from the increased macrophyte growth.



Figure 1: Photo series of the events taking place at the Rauwbraken.

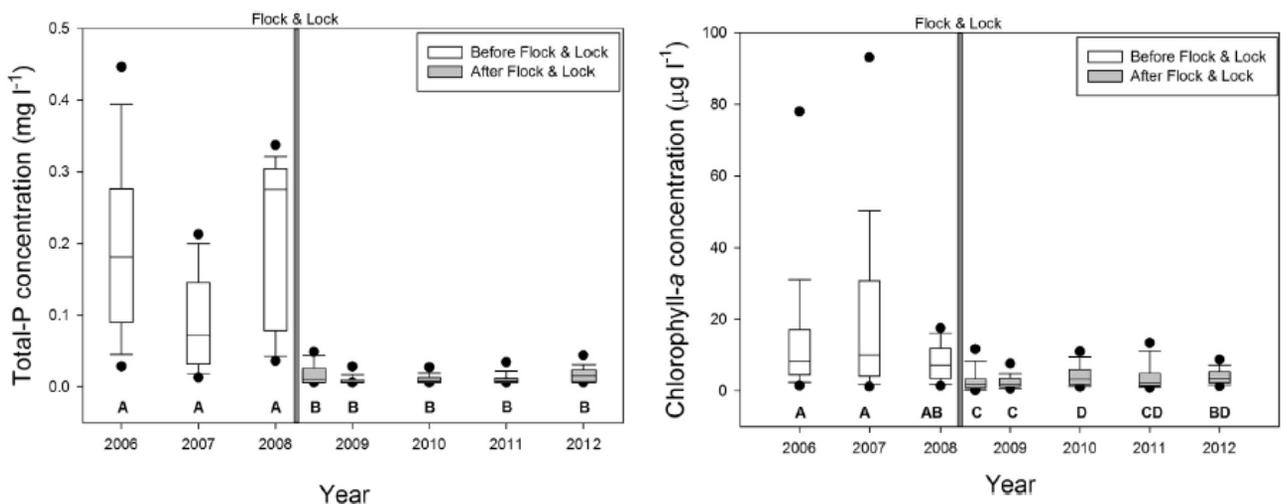


Figure 2 (Left): Total Phosphorus (TP) concentrations (in mg P l⁻¹) per year taken from Lurling, M., & van Oosterhout, F. (2013). TP concentrations in Lake Rauwbraken since 2006. The white boxes are prior to the Flock & Lock application and grey boxes are up to 4 years after the application.

Figure 3 (Right): Chlorophyll-a concentrations (in µg l⁻¹) per year taken from Lurling, M., & van Oosterhout, F. (2013). Chlorophyll-a concentrations in Lake Rauwbraken since 2006. The white boxes are prior to the Flock & Lock application and grey boxes are up to 4 years after the application.

News from Overseas: Australia

Application of Phoslock to Ellen Brook in Western Australia



As a product developed by the Land and Water Division of the CSIRO in Perth with funding from the Government of Western Australia's Water Resources Commission and Water and Rivers Commission, Western Australia can in many respects be considered the true home of Phoslock. Although the product has been successfully applied to Western Australian waterways for over 10 years, it is gratifying to see the product now being widely used around the world.

In October 2013, the Swan River Trust applied 50 tonnes of the product to the Ellen Brook, a significant source of phosphorus entering the Swan River. The Swan

River is an iconic waterway which flows through the centre of Western Australia's capital city of Perth before discharging into the Indian Ocean. Due to the hot and dry summers that the city experiences each year, algal blooms have become an increasingly regular occurrence in areas of the Swan River and the Western Australian and the Commonwealth Governments have in recent years introduced a number of innovative strategies aimed at combatting these blooms.

The reduction of nutrients entering the Swan River from Ellen Brook is one such strategy. Although algal blooms are not a serious issue in Ellen Brook, modelling has shown that the Brook exports more than 70 tonnes of nitrogen and more than 10 tonnes of phosphorus into the Swan Canning river system each year. The application of 50 tonnes of Phoslock to the Brook has the theoretical capacity to bind 500kg of the 10 tonnes of phosphorus

entering the Swan River each year, thereby assisting the Trust to achieve the 79 percent reduction in phosphorus entering the Swan River that is sought under the Swan Canning Water Quality Improvement Plan.

Compiled from sources provided by the Swan River Trust.



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The most obvious visible change in the lake's condition has been its increased secchi depth (up to 10 m in November 2008) and a resulting increase in the growth of macrophytes at greater depths (at 9 m depth).

These results are also reflected in the significant decrease in the chlorophyll-a concentrations in Lake Rauwbraken after the Flock & Lock application in 2008 (Figure 3). The

concentration of chlorophyll-a has remained low over time and has contributed to a reduction in the lake's trophic status from hypereutrophic prior to the application to now being classified as oligo-mesotrophic.

Source: *Lurling, M., & van Oosterhout, F., 2013, Controlling eutrophication by combined bloom precipitation and sediment phosphorus inactivation, Water Research, 1;47(17):6527-37.*

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For questions about any of the information contained in this newsletter please email info@phoslock.eu