

# Het Groene Eiland, Appelterm, Netherlands

Application dates: 16-17 April 2008 (initial treatment); 31 March 2009 (follow up treatment)

## Summary

**Aim:** Prevention of blue green algae blooms by reducing phosphorus concentrations

**Description:** Recreational water body which was formerly part of Maas River

**Size (ha)** 5.3

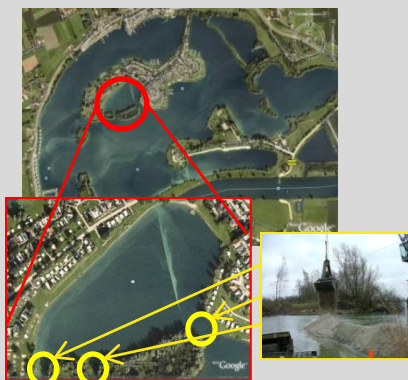
**Max. depth (m)** 4.5

**Average depth (m):** 2.5

**Conductivity ( $\mu\text{S/cm}$ ):** 360

**Dosage:** 11 ton Phoslock® (16,17/04/08)  
3 ton Phoslock® (31/03/09)

## The Lake



The lake "Het Groene Eiland" is part of "De Gouden Ham", a large bay which was formerly an arm of the River Maas near the town of Appelterm. The lake is a pleasant recreational facility used by visitors of the camping park ([www.hetgroeneiland.nl](http://www.hetgroeneiland.nl)).

"Het Groene Eiland" was separated from "De Gouden Ham" in February 2008 when a series of dams were built between the two water bodies. This was undertaken so that the water quality in the lake could be managed independently of "De Gouden

Ham". The newly formed lake has a surface area of approximately 5.3 hectares and a total water volume of 130,000 m<sup>3</sup>. There is no outflow and only a very limited catchment area, with inflow derived primarily from precipitation and groundwater.

Due to its limited depth the lake does not stratify during summer.

The sediment consists mainly of sand and to a lesser extent clay-like mud.

Total phosphorus and phosphate were measured to be 1000 and 120 mg P/kg dry weight respectively on the 15<sup>th</sup> of October 2007.

Reports on water quality in "The Gouden Ham" in 2006 and 2007 indicated algal blooms dominated by the blue green algae Microcystin with levels above the 20  $\mu\text{g/L}$  threshold which resulted in public swimming bans during both these years.



## The Treatment

Eleven tonnes of Phoslock® were applied on the 16<sup>th</sup> and 17<sup>th</sup> of April using a pontoon based application system. It was intended that the application would remove 110 kg Phosphorus from the available nutrient pool of both the water column and the releasable fraction of the sediment for the entire lake. Phoslock® was mixed with in situ water pumped



from the lake in a venturi mixing system installed on a pontoon and then sprayed evenly over the surface of the lake. No Phoslock® was applied to the shallow areas near the shore or the swimming areas. The application was performed by Bentophos GmbH.

A number of additional measures were also undertaken in conjunction with the Phoslock® application. These included: the planting of reedbeds, removal of shading plants and trees along the shoreline and fish and bird management.

An additional 3 tonnes of Phoslock® were applied on the 31<sup>st</sup> of March 2009 to bind new inputs of phosphorus which had entered the lake through ground



water and (unintentional) run-off from nutrient rich ash. During the second treatment, Phoslock® was applied mainly to the deeper areas. The Phoslock® granules were applied dry (without extensive mixing) to increase the settling behavior and target the sediment phosphorus rather than the water.

# Het Groene Eiland

## Results



Lakes are dynamic systems with seasonal and yearly variations in nutrient and algal concentrations due to sunlight and temperature differences. Although the visual appearance of the water is a somewhat subjective parameter, it does provide an indication of differences in water quality between “Het Groene Eiland” and the untreated “De Gouden

Figure 1 left: Photo series comparing the visual differences between the water at Het Groene Eiland and De Gouden Ham. (Photos courtesy of A. van Ooijen)  
Figure 2 right: Situation on 16/08/08 with Het Groene Eiland on the left and De Gouden Ham on the right (Photo courtesy of A. van Ooijen)

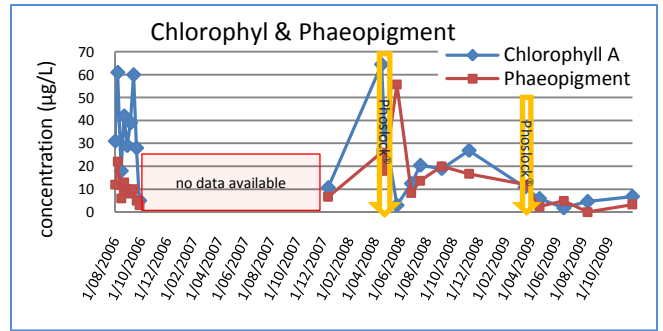
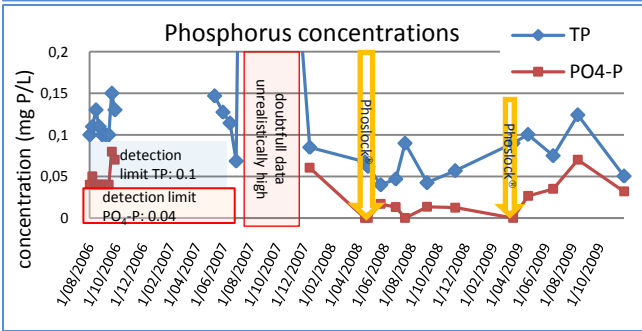
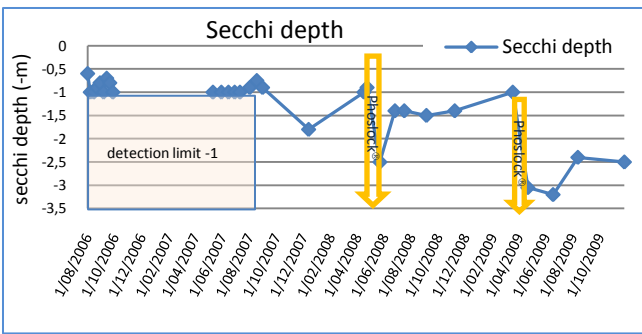
Ham”. Shortly after the Phoslock® application, no visual difference could be noticed. On the 23<sup>rd</sup> of July 2008, an algal bloom became apparent in both water bodies, although less pronounced in “Het Groene Eiland”. However on the 24<sup>th</sup> of July, algae in “Het Groene Eiland” were no longer visually present and the lake remained clear for the rest of the year. In

“De Gouden Ham”, on the other hand, algae remained visible from the 23<sup>rd</sup> of July until the beginning of autumn 2008. The improved situation can also be seen in the graphs, however care should be taken when comparing values from before and after the first treatment as they were obtained using different methods on a physically different water body.



Graphs Top Right (3): Secchi depth (sediment at 3.4m), Bottom Left (4): Phosphorus concentrations, Bottom Right (5): Chlorophyll and phaeopigment concentrations; All concentrations are averages from water at 1 m below the surface and above the sediment; Pretreatment monitoring Zwemwaterprofiel 2006 by Grontmij & DHV, Onderzoek Blauwalgen De Gouden Ham, Rapportage 2007” by Drema, Post treatment monitoring and analysis by Institut Dr Nowak.

Graph 4 (bottom left) shows that the average phosphorus concentrations are generally lower after the treatment with Phoslock®. However there appears to be some influence from P-contaminated ground water gradually increasing the P-content of the lake.



## Conclusion

The application of Phoslock® to “Het Groene Eiland” has influenced the lake system by reducing the overall availability of phosphorus to the phytoplankton biomass. As a result the biomass has decreased, which in turn has increased the transparency of the water. This effect became most pronounced visually when comparing the water of “Het Groene Eiland” with the untreated water of “De Gouden Ham”

during the summer of 2008. The increased transparency and the absence of blue green algal blooms are secondary effects of the Phoslock® treatment, but were the main goals for the customer and recreational users of the lake. Therefore based on the results to date the treatment of Het Groene Eiland by Phoslock® can be considered successful.

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Additional information can be found on our website or can be provided on request.