

The Serpentine, London, United Kingdom

Application dates: 27th February- 1st March 2012

Summary

Aim: to lower phosphate concentrations and reduce algal blooms experienced in the summer months

Description: recreational lake

Size (ha): 16.2

Max. depth (m): 4.5

Average depth (m): 5.3

Dosage (tonnes): 55.6 (The Serpentine)
10.5 (The Long Water)

The Lake



Figure 1: Aerial view of The Serpentine and The Long Water (Google Maps)

The Serpentine is a recreational lake in Hyde Park, London, England. It was created in 1730. The Serpentine takes its name from its snakelike, curving shape, although it only has one bend. The Serpentine is commonly used to refer to the entire water body, however it is strictly only the eastern part of the lake. The western boundary of the Serpentine is marked by the Serpentine Bridge between Hyde Park and Kensington Gardens. The long and narrow western half of the lake is known as The Long Water.

Water entering the lake has historically originated from a number of sources. When the water body was established in the 1730's the lake was originally fed by the River Westbourne and Tyburn Brook. In the 1830's the water was pumped from the River Thames. Currently the water is pumped from 3 boreholes in Hyde Park (with the 3rd brought on line during the lakes restoration in 2011/12). Prior to the boreholes coming on line, the lakes turnover was 10 years, now the turn over time is 4-5

months.

The water body is primarily used for boating but was also used for the men's and women's triathlon and marathon swimming events in the London 2012 Olympics.

Phoslock was applied in order to reduce the amount of phosphate in the water/sediments and improve the quality leading up to the Olympics.



Figure 2: Phoslock application to the Serpentine

The Treatment

Prior to the application of Phoslock, water samples were taken. The lake was divided into three zones (Figure 3) and the quantities applied to each zone were calculated as a percentage of the total water volume. The quantity applied to Zone 1 was increased by 25% over its theoretical requirement in an effort to (a) create a filter bed in this area to adsorb additional phosphate flowing into the Serpentine from Long Water (the inflow water body) and (b) compensate for the fact that this area is very shallow and

therefore likely to have a deeper layer of sediment interacting with the water column. The quantities applied to the other two zones were each reduced by 0.5 tonnes in order to compensate. The applications were undertaken using a Phoslock slurry unit mounted on a flat bottomed barge. This system converts granular Phoslock into slurry using *in situ* lake water before dispersing it onto the surface of the water body through a spray boom.



Figure 3: Photo of the Serpentine showing the theoretical application zones



Figure 4: Application of Phoslock to the Serpentine using a barge

The Serpentine

Results

A number of remediation measures were undertaken in 2012. These included fish (carp and bream) removal, aeration, macrophyte removal, water pumping and a Phoslock application. Due to the number of strategies, water samples were collected from 4 locations with phosphate results displayed in Figure 5. Figure 5 shows that the Phoslock application was carried out between 27th Feb -1st March 2012. Data shows that during August/September 2011

concentrations of phosphate were much higher than those during the same months in 2012. Samples collected from The Serpentine showed an immediate and sustained reduction in phosphate to ≤ 0.02 mg/L (the detection limit). Concentrations only increased around the time the macrophytes were removed from the water body. This suggests that the plant cutting disturbed the sediments and caused the release of phosphate into the water column. Data from

water samples taken from the Long Water were observed to increase from May 2012. It is possible that due to the shallow depth of this section of the water body, the effects of water birds, wind or another site specific issue was responsible for the increase in phosphate. Due to access difficulties, some of the Phoslock was not sprayed in the upper reaches of the Long Water, leaving this area untreated. Some of the phosphate may have been released from these areas several months after the application.

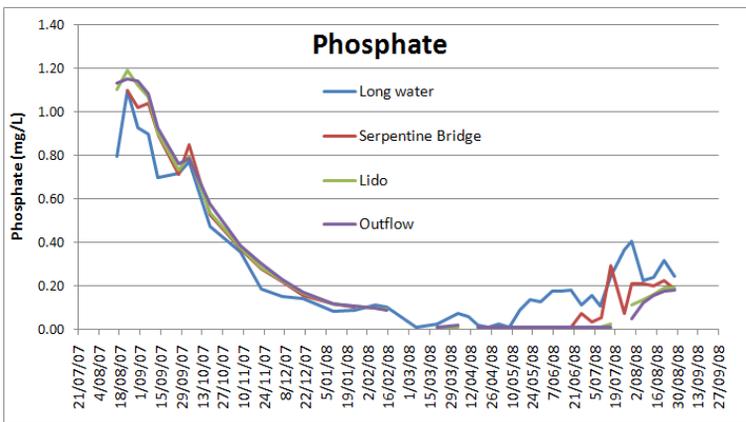
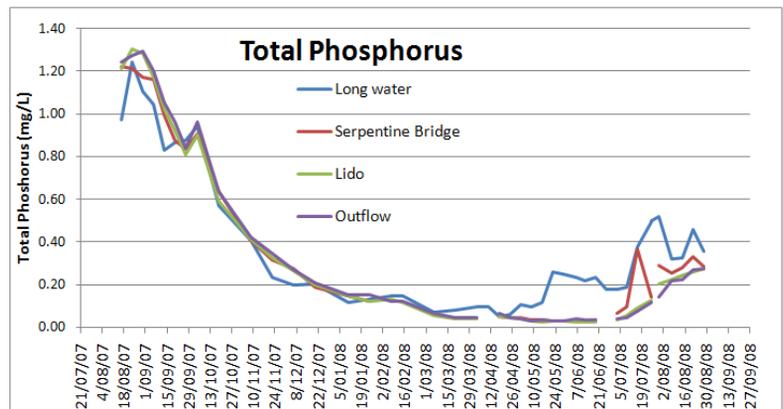


Figure 6 shows that there was a corresponding reduction in the amount of total phosphorus (TP) in both the Serpentine and the Long Water. The TP slowly increased in the Long Water over time, however remained at the level of detection until the removal of macrophytes (where sediments would have been disturbed and TP released into the water column i.e. colloidal material from the sediment and organic material from the macrophytes).

Figures 5 & 6: Phosphate and Total Phosphorus concentrations in the Serpentine and Long Water prior to and after the Phoslock application (data provided by Haycock Associates and The Royal Parks).



Conclusion

The Phoslock treatment had a significant and sustained reduction in the water column phosphorus (phosphate and total phosphorus). Results from the Phoslock application along with other measures undertaken in the water body during 2012 were encouraging and water quality was significantly better in 2012 than in 2011. Nevertheless, The Long Water and The Serpentine are still undergoing recovery from a prolonged period of eutrophication.

Smaller "top up" applications of Phoslock may be necessary in coming years to treat the upper reaches of The Long Water, the deeper layers of sediment in The Serpentine, and to bind new inputs of phosphorus entering the water column. This includes the phosphate released from any remaining macrophytes that decompose over the winter months.

Publication date: January 2014



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