Case Study

Hydro International®

DynaSand® 20 Year Track Record in Sweden Proves Ability for Phosphorus Removal

Project profile

Objective

To reduce excessive levels of phosphorus in the lakes of Växjö, southern Sweden which were causing widespread algae blooming.

Solution

- Step 1 was to dredge the phosphorus leaking sediment out of the lakes.
- Step 2 - a new sewage treatment works was built which incorporated a two-stage phosphorus removal, of which 60 DynaSand® filters were an integral part of Stage 2.

Product performance capabilities

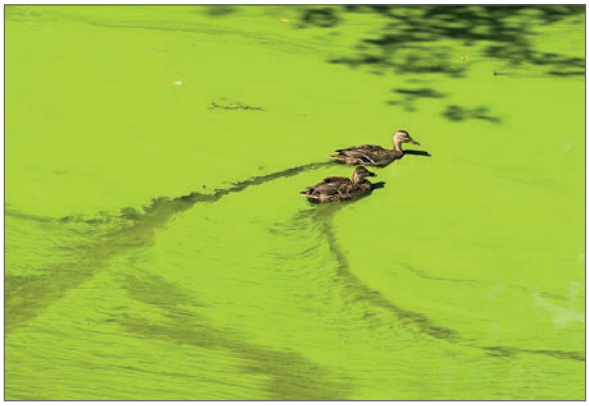
Feature	DynaSand®
Effluent TSS Removal	Down to 10 mg/l *
Effluent BOD Removal	Down to 10 mg/l *
Effluent Phosphorus Removal	Down to 0.1 mg/l **
Effluent Ammonia Removal	N/A
Effluent Nitrogen Removal	N/A
Maximum Flow-rate per filter	29 l/s

* effluent standards quoted to 95%ile
** annual average

The challenge

Two decades ago, the community Växjö in southern Sweden faced considerable environmental problems in the form of excessive levels of phosphorous in its local lake system. Växjö is located in central southern Sweden, about 400 km south of Stockholm. Their issue with phosphorous sedimentation in the lakes has been going on since around the turn of the century and originates from the historic discharge of raw sewage. Historically there was also a linen factory, a butchery and other industries located in the area that had an impact on the phosphorus sedimentation in the lake system.

It was estimated that the local lake Norra Bergsundasjön could absorb a maximum of 1 ton of phosphorus per year without damaging the eco system in the lake. During the 10 years before this estimate, an average of approximately 1.9 tons had been emitted from Växjös old treatment plant and discharged to the lake. Beyond the emissions from the old treatment plant, an additional 2.8 tons of phosphorus was leaking into the lake water from the phosphorus rich sediment in Norra Bergsundasjön and other surrounding lakes. The phosphorus emissions to the lake were consequently almost five times larger than what the lake could handle, resulting in a widespread algae blooming.



The solution

This issue was approached in two steps, where the first step was to dredge the phosphorous leaking sediment out of the lakes. The second step was building a new sewage treatment plant which incorporated a two-stage phosphorous removal process, where the second stage involved contact filtration ie. flocculation. This was provided by the DynaSand® continuous sand filter, where the flocculation was performed within the filter.

The new sewage treatment plant was built in 1994 and was named Växjö Sundet. Phosphorus removal at Växjö Sundet is achieved in two stages to meet the plants outlet requirement of 0.2 mg/ l of total phosphorus. The first stage is located after the initial mechanical treatment and before the biological stage. Chemicals, generally iron sulfate, are added to precipitate phosphorus into flocs which are then removed by sedimentation.

The second phosphorus removal stage is filtration through continuous sand filters. The filter stage is the last element in the treatment process chain and consists of 60 DynaSand® filters. The 60 DynaSand® filters are divided into six separate treatment lines, each equipped with 10 DynaSand® units housed in concrete structures; a compact solution, about the size of a tennis court, with a total filter area of 300 m^2. The filtration rate in Växjö sundet is 5 to 10 m per hour. The procedure in the second phosphorous removal stage is very similar to the first in the aspect of adding ferric salts to precipitate the phosphates which are later removed. The same precipitant is added just before the flow enters the sand filters where the solid phosphates are removed. The solid phosphates are removed from the sand in the integral sand washer. The separated phosphates are channelled back to the plant inlet for re-treatment.

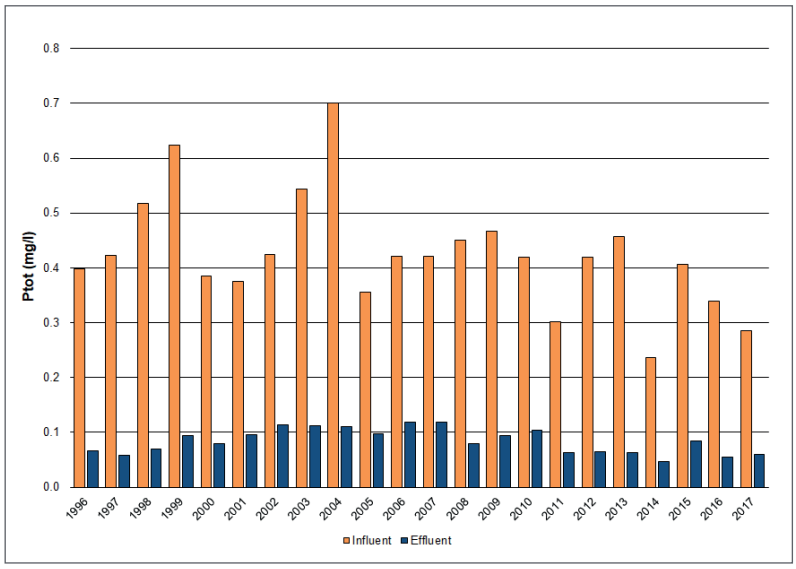
Performance data

The sewage treatment plant Växjö Sundet has now been in operation for over two decades and maintains an excellent performance record. The plant has a population equivalent of 85,000 of which 25,000 is from industrial sources.

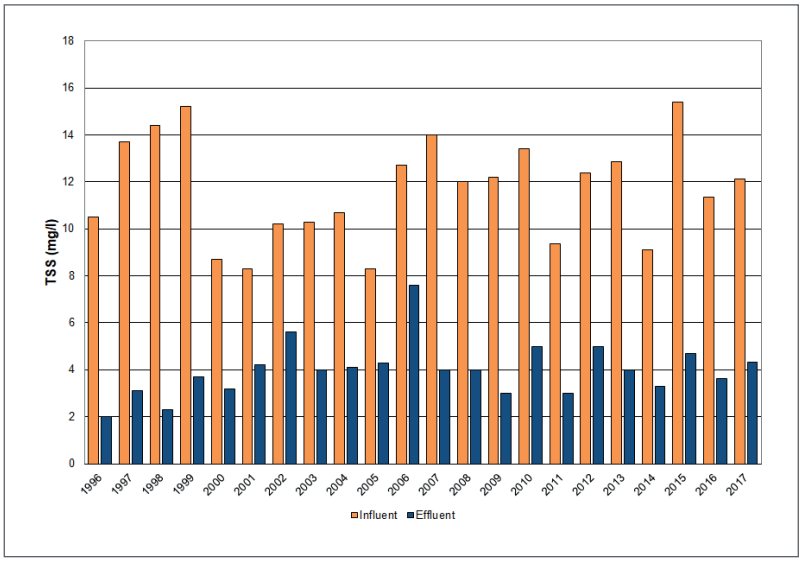
Average daily inflow	28,700 m^3 (ie. circa 1,500 m^3/h)
Maximum estimated flow	3,000 m^3/h
Phosphorus content of inflow	170 kg per day (4.7 mg/l average)
Phosphorus content of outflow	< 0.2 mg/l

The phosphorus content in the outlet water corresponds directly to the amount of chemical dosing (iron sulfate).

Annual averages of 0.05 mg/l have been achieved. The incentive to get as low as 0.05 mg/l is limited, but increased chemical dosage during some years show how ambitious the phosphorus reduction could be. The amount of total phosphorous (P_{tot}) coming into the DynaSand® filters over the years 1996-2017 are plotted together with the outgoing values of phosphorus in the graph below.



Annual average of P_{tot} in the inlet to/outlet from the tertiary DynaSand® filters over the years 1996-2017. The graph shows that the phosphorous content in the outlet is way below the required 0.2 mg/l total phosphorus.



Annual average of suspended solids in the inlet to/outlet from DynaSand® filters over the years 1996-2017. In terms of suspended solids in the outlet the process guarantee states that it must be below 8 mg/l.

To sum up the presented data the outgoing value of the suspended solids has over the years 1996-2017 never exceeded the process guarantee value and the phosphorus content in the outlet is way below the plant Växjö Sundets requirement.

The DynaSand® filters consistently deliver substantially lower phosphorus content than the 0.2 mg/l consent, with effluent concentrations regularly below 0.1 mg/l.

Learn more

To learn more about how the DynaSand® can help you to manage water more effectively, visit **hydro-int.com**, search **Hydro DynaSand** online or contact us:

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