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Decentralized urban greywater treatment at Klosterenga Oslo

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Introduction

Today it is possible to foresee completely decentralized wastewater treatment systems in urban areas where the blackwater fractions (urine and faecal matter) is reclaimed for fertilizer and potentially energy production (Jenssen et al 2003). The water from kitchen sinks and showers (greywater) is treated locally in compact low maintenance systems that constitute attractive landscape elements (Jenssen and Vråle 2003). These systems can coexist with decentralized water supply.

Greywater composition and treatment needs

Greywater contains little nutrients (nitrogen and phosphorus), because 90% of the nitrogen and 70-80% of the phosphorus in the blackwater. Greywater may contain more than 50% of the organic matter and, surprisingly, a relatively high content of bacteria and even virus (Ottoson 2003). If greywater is discharged to smaller streams in urban areas or used for irrigation or groundwater recharge advanced treatment that reduce organic matter and the hygienic parameters is needed.

System design

At Klosterenga, in the capital of Norway, Oslo, the greywater is treated in an advanced nature based greywater treatment system in the courtyard of the building. The system consists of a septic tank, pumping to a vertical down-flow single pass aerobic biofilter followed by a subsurface horizontal-flow porous media filter.

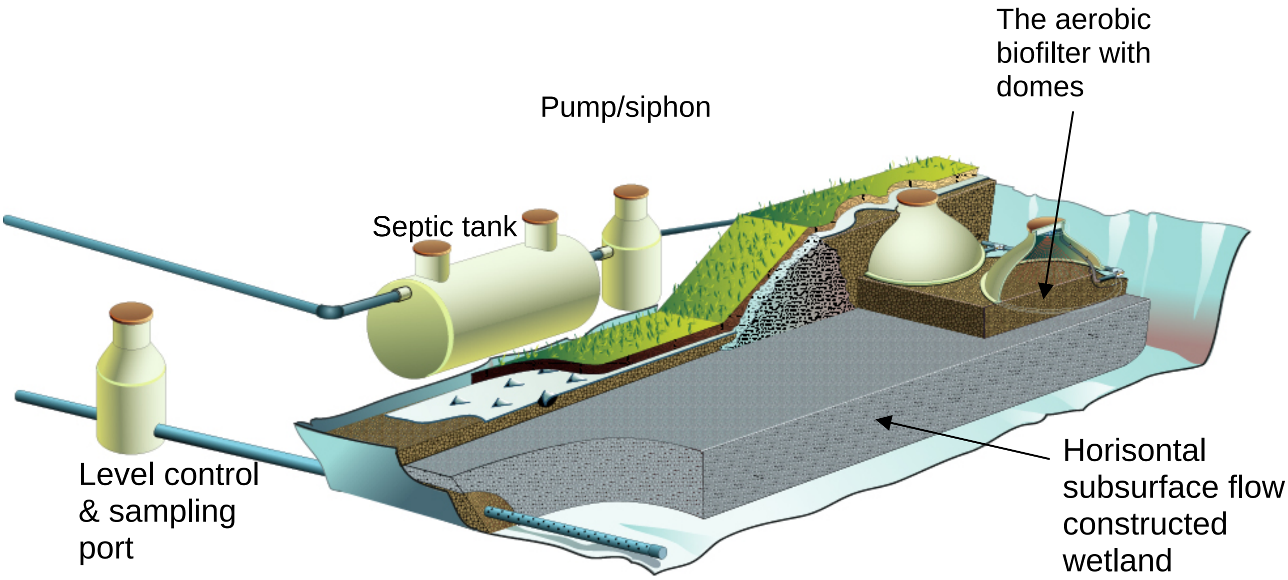

Figure 1. The latest generation of constructed wetlands for cold climate with integrated aerobic biofilter in Norway.

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Results and comments

The Klosterenga system was built in 2000 and has consistently produced an effluent quality averaging to:

- COD 19 mg/l
- Total nitrogen 2,5 mg/l
- Total phosphorus 0,03 mg/l
- Faecal coliforms 0

For nitrogen the effluent has consistently been below the WHO drinking water requirement of 10 mg/l and for bacteria no faecal coliforms have been detected. The space required for this experimental system is about 1 m^2/person, and part of the treatment area is also used as a playground (Fig. 2). Additional aeration, in the summer season, is provided by a flow-form system (Wilkes1980). This is not necessary for the treatment performance but adds aesthetic value. It is estimated, that saturating the wetland media with phosphorus will take more than 40 years at Klosterenga. This is due to a new light weight expanded clay aggregate (LWA), FiltraliteP^{TM}, which has very high phosphorus sorption and bacteria reduction capabilities. Preliminary investigations indicate that systems with FiltraliteP has potential for excellent virus reduction.

Fig. 2. The klosterenga greywater treatment system. Upper right; the wetland in the foreground the biofilter is underneath the playground behind the stonewall. Upper left; Flowforms. Lower left the effluent is exposed in a shallow pond. Discharge to a local stream is possible is the stream was reopened.

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With such high qualities of the effluent water, as shown above, the need for a secondary sewer collection system is reduced because local streams or water bodies can be used for receiving treated water even in urban areas.

Conclusion

A combined vertical flow biofilter followed by a horizontal flow wetland filter for advanced greywater treatment is developed. The total area requirement is $1m^2$/ person and the effluent meets European swimming water standards with respect to indicator bacteria and WHO drinking water standards with respect to nitrogen. The low area requirement of the system and the high effluent quality facilitates use in urban settings, discharge to small streams, open waterways or irrigation or groundwater recharge.

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