OPTIROC

ONSITE WASTEWATER TREATMENT FOR HOUSES AND HOLIDAY HOMES IN RURAL AREAS

FILTER BED

filtralite

Filter bed with prefilter

Filter beds with prefilter are simple, efficient and environment-friendly ways of treating domestic wastewater from detached houses and holiday homes. The requirements relating to operation and maintenance are few in relation to traditional compact plants. These systems can also be adapted to suit clusters of houses, schools, kindergartens, small companies etc.

This brochure contains an example of how filter beds with subsurface flow can be built.

The treatment performance of filter beds is dependent on the plant being built correctly. We recommend that companies, which possess the necessary expertise for building filter beds, are responsible for planning and execution of such.

Treatment plant in the garden

In order to avoid any misunderstandings: "Filter bed" in this context is not the same as a traditional constructed wetland. Some literature refers to the system described in this brochure as a subsurface flow constructed wetland. It does not mean that you, in your capacity as a house owner, have to prepare a wetland area in your garden. Filter bed in this context means a basin filled with filter material, which is established below ground and through which wastewater runs as part of the treatment process. It is quite possible, for example, to plant a lawn over the plant once it has been completed.

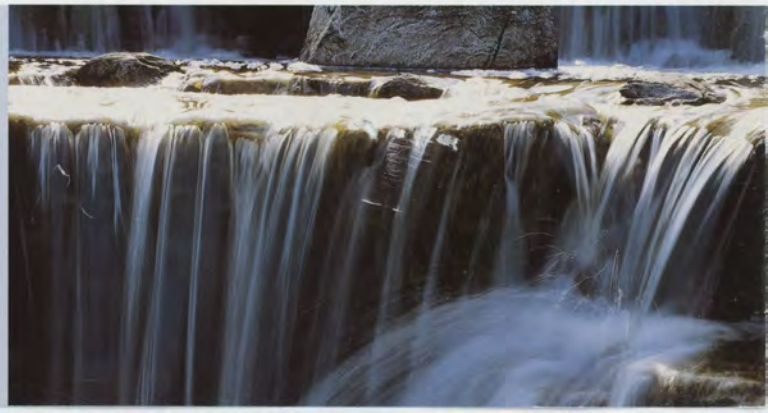
Guidelines

The Norwegian foundation entitled "NKF og NORVAR's VA/Miljø-blad" (NKF and NORVAR's Water and Sewerage/Environment Guideline) has prepared "VA/Miljø-blad No. 49: Våtmarksfiltre" (Filter beds), which provide guidelines relating to the design and layout of such plants. "NKF og NORVAR's VA/Miljø-blad" is founded by NKF (the Norwegian Municipal Engineering Association) and NORVAR (the Norwegian Water & Sewerage Works Association).

The size and scale tables in this brochure are based on the guidelines contained in "VA/Miljø-blad No. 49" and made in cooperation with the Agricultural University of Norway.

Registered trademark

Filtralite consists of specially manufactured Leca granules designed specially for water and sewage treatment. Filtralite is Optiroc's registered trademark for all its expanded clay products, which are used as filtration media in the treatment of water. Filtralite is used in many different water filtration processes.



Treatment performance

The treatment performances shown below are conditional on the filter bed having been designed in accordance with "VA/Miljø-blad No. 49" using Filtralite P as a filtration material in the filter basin.

Parameters	% Removal	Typical discharge concentrations
Total phosphorus	> 90%	< 1 mg/l
Organic matter (BOD_7)	> 80%	< 20 mg/l
Total nitrogen	30-70%	
Nitrification	50-99%	
Thermotolerant bacteria	> 99.9%	< 1000 TCB/100ml

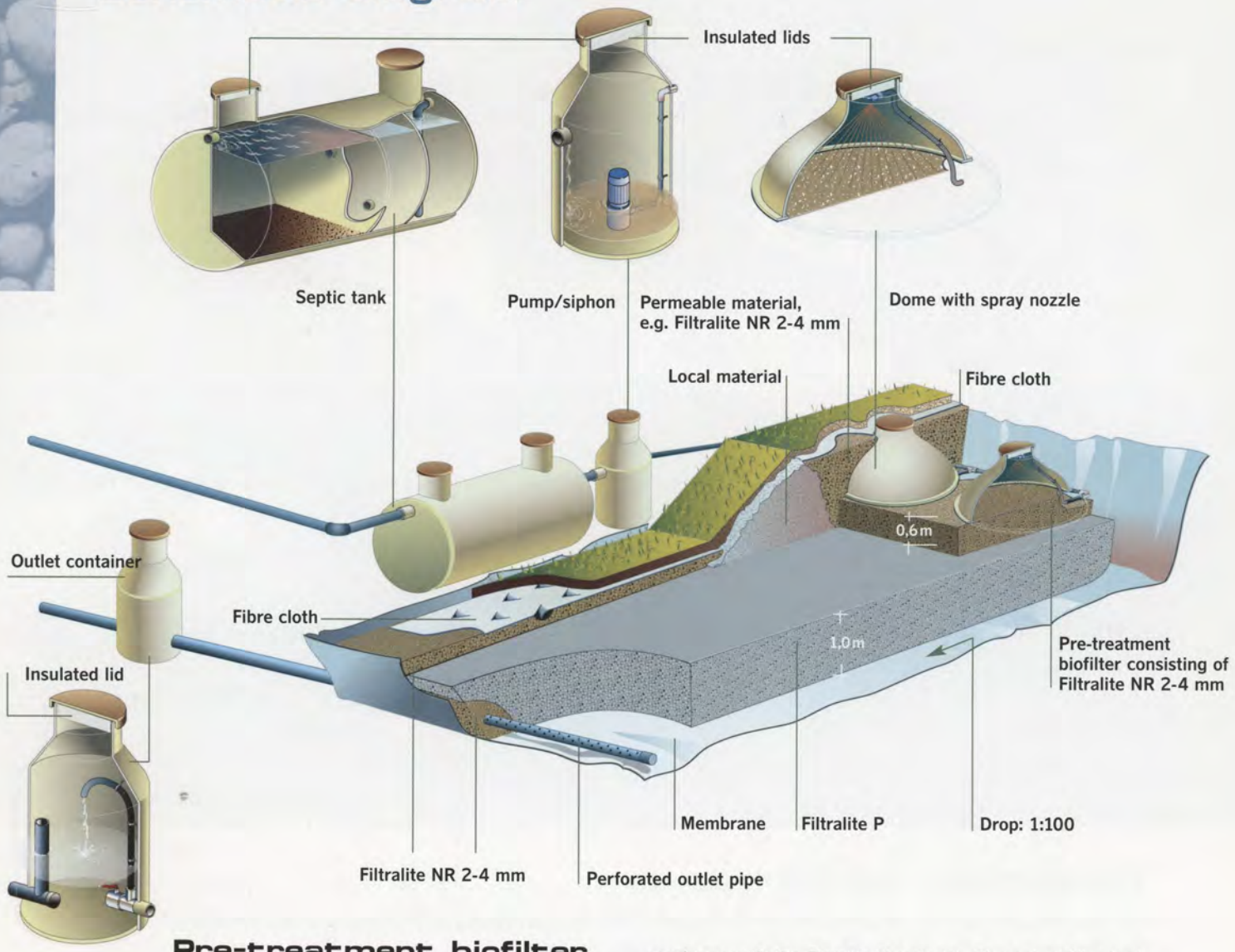
During the first few years the wastewater will have high pH values (pH = 10-12) due to high concentrations of calcium compounds in the Filtralite P material. This will not normally have a negative effect on the receiving environment.

Filtralite on the Internet

Information about Filtralite is available on the Internet:

www.filtralite.com is an English website. It contains i.a. product data sheets relating to the various types of Filtralite (which can also be obtained from all our offices, see back page).

Schematic diagram



Pre-treatment biofilter

The wastewater initially runs through a septic tank (see the schematic diagram), and is then pumped to the down-flow aerobic biofilter, which consists of a 60 cm thick layer of Filtralite NR 2-4 mm. The biofilter, where organic materials are removed from the wastewater, is the first phase of the treatment process after the septic tank. One or more domes are placed above the biofilter and serves as a hemispherical cover. The domes shown in this brochure have a diameter of approx. 2.0 meters. A nozzle in each dome enables wastewater to be sprayed over the filtration surface. The nozzles ensure that the water is sprayed evenly and that maximum usage is made of the filtration material. The wastewater runs vertical through the filter. The biofilter may be placed over the filter bed or in a separate location. The biofilter shown in this brochure is placed over the filter bed.

Filter bed

The main purpose of the filter bed is to remove phosphorus from the wastewater. This occurs as the phosphorus combines with the Filtralite P material. The actual filter bed is an excavated basin filled with Filtralite P at a depth of approx. 1.0 meter. The filter bed is established with a slight slope at the bottom (1:100). At the point where the biofilter is positioned above the filter bed, the water runs vertically through the biofilter and down into the underlying basin containing Filtralite P. If the biofilter is placed in a separate location, a transmission pipe from the biofilter to the filter bed and a distribution pipe where the pipe enters the filter bed need to be installed.

Watertight walls

The walls and base of the filter bed basin must be watertight, so that water cannot leak out. Laying a membrane in the trough before filling it with Filtralite P can do this.

Outlet to river, stream, lake or ground

The water runs slowly through the filter and the outlet system at the end of the filter basin, and it enters a container

where a flexible tube is used in order to control the level of the water in the filter bed. The treated water is then channeled from the container to a stream, river, lake or infiltration to the ground (i.e. the recipient).

Usually outlet permission has to be obtained for discharge of the purified water. Routines on how this is done vary in different countries.

Lawn or plants

A lawn or wetland plants may be planted on top of the filter bed. Because of the high pH level in the filter, it will take a few years before the wetland plants start to thrive.

Long life

Calculations and experience with filter beds which have been in operation for up to 10 years, indicate that phosphorus treatment can last for up to 15 years. For sites with a greater load than that specified in VA/Miljø-blad No. 49, the lifetime may be reduced. The operation of the nozzles, pump and any blockage of the biofilter should be checked on a regular basis. We recommend that the pump should be fitted with an alarm.

Recycling

When the filtration material is due for replacement, it may be reused as soil fertilizer.

Different rules and regulations apply in different countries. Requirements for recycling of phosphorous saturated filter material for agricultural purposes demands that rules and regulations are met.

Other options

Filter beds may also be built using Filtralite NR 2-4 mm in the basin. The phosphorus treatment performance will be reduced, but the nitrogen treatment effect will in most cases be better. This could serve as an alternative solution in less sensitive areas, but this will be dependent on the discharge limits imposed by the local council.

Dimensioning tables

In order to obtain an idea of the approximate size of filter beds, the length and width of two typical plants for 1 to 4 houses are shown below. Table 1 shows the size and amount of Filtralite needed for treating wastewater from 1 to 4 houses. Table 2 shows the same parameters for treatment plants for treating wastewater without toilet wastes for 1 to 4 houses.

Table 1: Wastewater treatment plant for 1 to 4 houses

No. of houses	Biofilters, no. of domes	Amount of Filtralite P (m^3)	Minimum width B (m)	Length L (m)	Approx. amount of Filtralite NR 2-4 mm* (m^3)
1	2	40	4,5	8,9	11
2	3	70	8	8,8	19
3	4	100	11,5	8,7	27
4	5	130	15	8,7	35

The plants as seen from above

Treatment plant for wastewater from one house:
The plant consists of a biofilter with two domes placed over the filter bed. The total area of the filter bed is 40 m2 for one house.

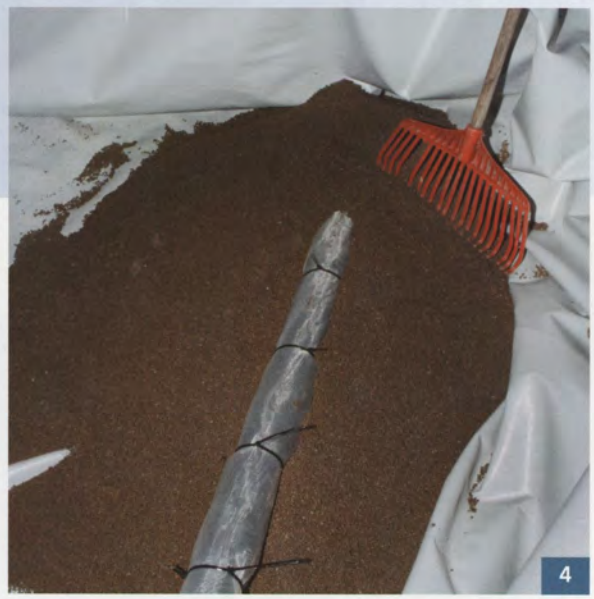
Table 2: Treatment plant for wastewater without toilet wastes - 1 to 4 houses

No. of houses	Biofilters, no. of domes	Amount of Filtralite P (m^3)	Minimum width B (m)	Length L (m)	Approx. amount of Filtralite NR 2-4 mm* (m^3)
1	1	15	3,6	4,2	7
2	2	26	6,3	4,1	12
3	2	37	8,9	4,2	17
4	3	48	11,6	4,1	22

Treatment plant for wastewater without toilet wastes from one house:
The plant consists of a biofilter with a dome placed over the filter bed. The total area of the filter bed is 15 m2 for one house.

*** biofilter height 0.6 m, outlet zone, cover 0.1 m (insulation).**

Building a filter bed with prefilter



1. Basin completed, compaction work in progress.
2. Laying the membrane.
3. Membrane laid and outlet pipe installed.
4. Filling up with Filtralite NR 2-4 mm beneath and around the outlet pipe
5. Filling up with Filtralite P

6 - 8. Cutting a hole in the membrane in order to make a passage for the outlet pipe. It is important that this joint is watertight in order to prevent water from leaking into the soil surrounding the filter bed.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9 - 11. When establishing a lawn above the plant, we recommend that you lay a fiber cloth between the lawn and the Filtralite material. One way of improving the flow of water to the lawn is to make incisions in the cloth, which can be pushed down into the underlying filter material. This will help moisture to be drawn up into the fiber cloth and to the lawn.

The incisions should be at least 15 cm long, with a minimum of 4 incisions per square meter.


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12 - 13. Filling up with frost-proof soil along the edges on the outside of the membrane. This is done in order to insulate the plant from frost, and to protect the membrane from protrusions and roots, etc., which could puncture the membrane. At the plant shown in the photograph Leca lightweight aggregate is filled along the edges.


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Foto: NPS / Tamanen

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