

On-site Sewage Treatment Using Single-Pass Sand Filter: - Case Study Design for 5 Ora Street, Gisborne

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Basic Design Information

It is important to acknowledge that the following sand filter design was done without the benefit of a site inspection. The following site information was provided by Gisborne District Council (GDC):

Number of occupants:	4
Water Supply:	mains water
Site constraints:	seasonally high water table (800mm below surface)
Soil Structure:	0-200mm = med-fine loamy sand 200-400mm = sandy loam 400-600mm = sandy clay > 600mm = clay

Sand Filter Design

A general schematic of the system layout is provided in Figure 1.

Estimated Hydraulic Load = 1440 L/day (as required by GDC)

Design Hydraulic Loading Rate = 100 mm/day

Sand Filter Area = $1.44 \text{ m}^3 \text{ day}^{-1} / 0.1 \text{ m day}^{-1}$
= 14.4 m^2

Sand Filter Dimensions = 3.6 m x 4.0 m (other dimensions may be more suitable for site. Please consult with me if changing dimensions).

Detailed specifications of sand filter design are provided in Figures 2, 3 and 4.

Note: please consult me if sand filter dimensions other than those given here are to be used (for practical or site reasons), or if a pump other than the Lowara DOMO 7VX submersible pump for which the inlet distribution system in this report has been designed. A range of other pumps may also be suitable, but require re-design of the inlet distribution system.

Sand Specifications:

The sand used should be durable, have a coarse (large) and fairly uniform grain size (judged by the d10 and uniformity coefficient) and be relatively clean (as judged by the % fines). The technical specifications are provided in Table 1. It may be desirable to have a particle size analysis conducted on the readily available sands within the Gisborne district in order to confirm suitability for use in sand filters.

Please feel free to consult with me if you have any questions about these specifications.

Table: Single Pass sand filter media specifications.

Characteristic	Media specifications
Effective size (d10)	0.25 – 0.75 mm
Uniformity Coefficient (d10 / d60)	< 4
Percent fine material	< 5%

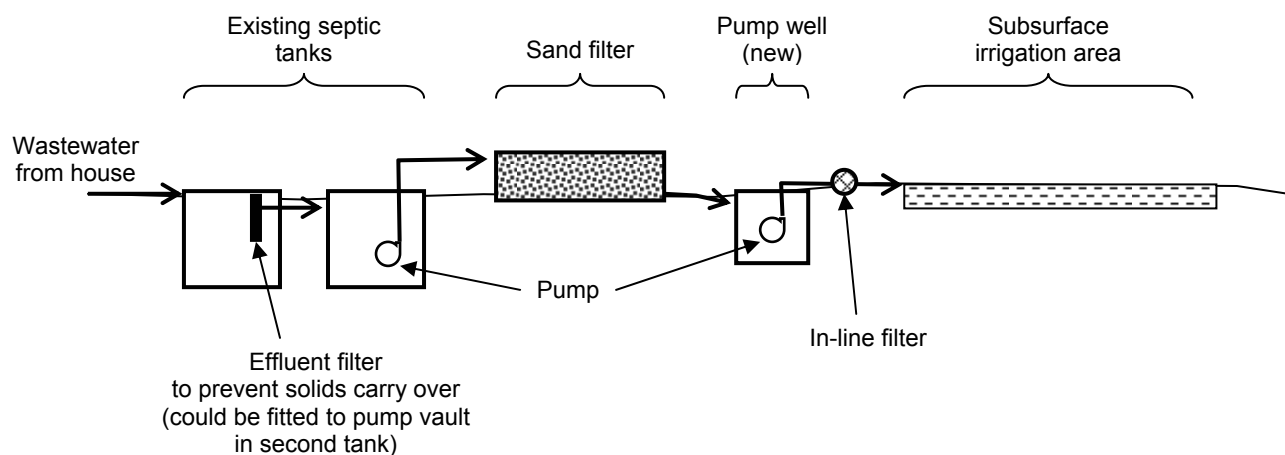


Figure 1: Lateral schematic of proposed on-site system including secondary treatment by a single-pass sand filter (note: details of disposal area not contained within this report).

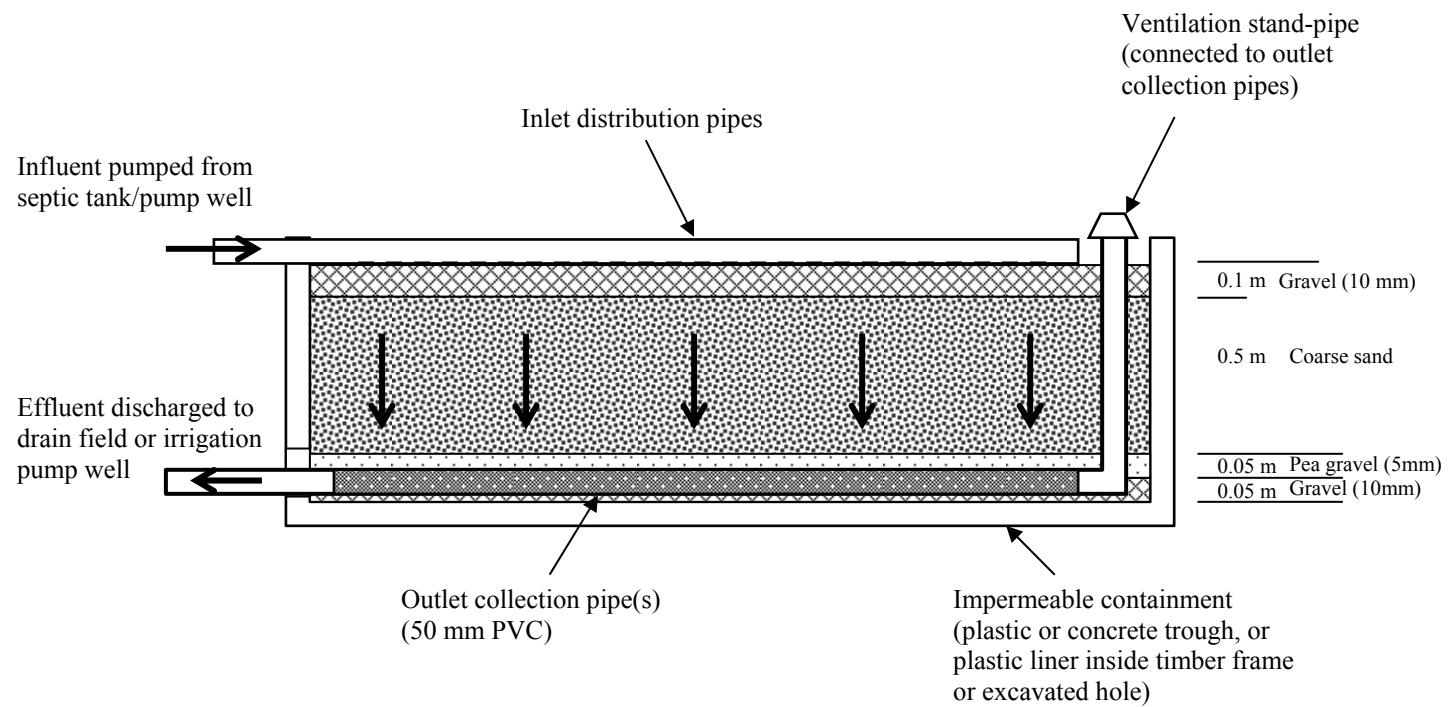


Figure 2: Lateral cross-sectional profile of typical on-site single-pass sand filter system.

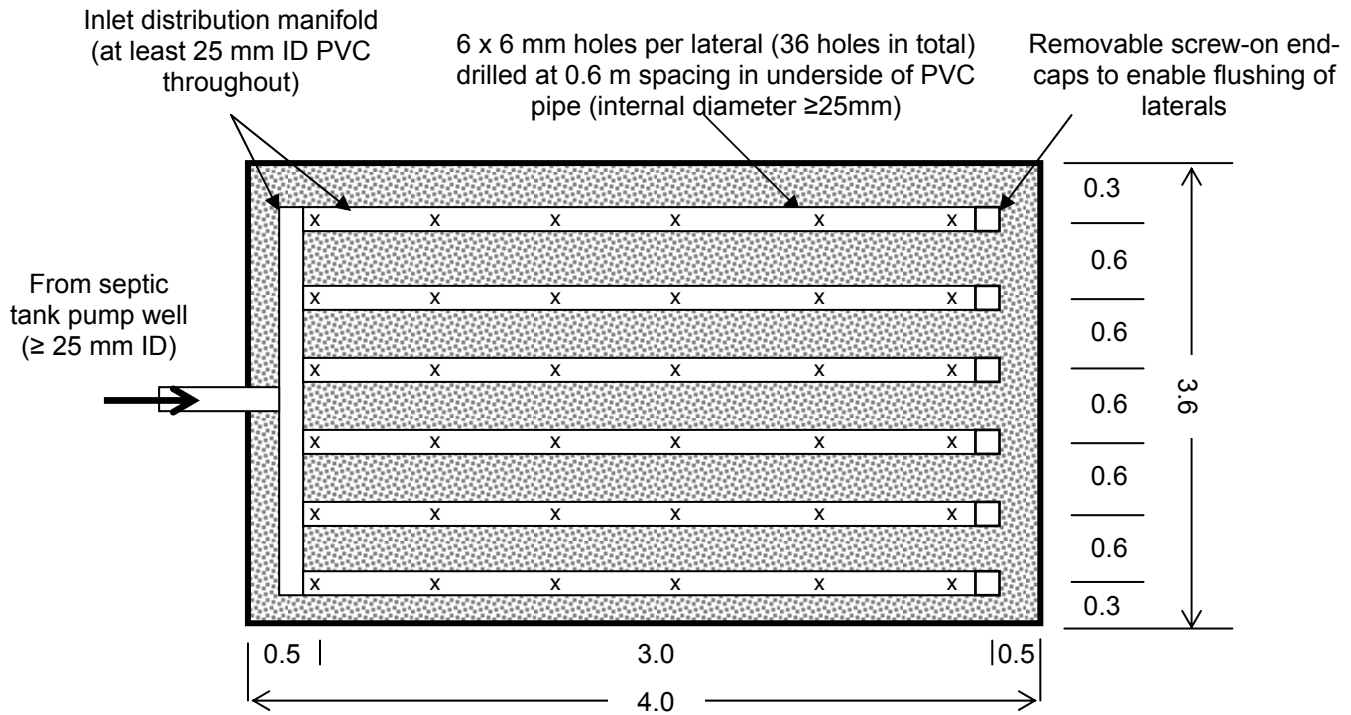


Figure 3: Plan view of inlet distribution system design for a 4.0 m x 3.6 m sand filter (all units are in metres unless otherwise stated). Pipes are located on top of filter bed. Pipe and orifice size, spacing and numbers are specific to the sand filter dimensions given here and assume the use of Lowara DOMO 7VX submersible pump. (**Note: other suitable pump can be used; however diameter and number of inlet pipes and orifices must be designed on a case by case basis according to pump characteristics and sand filter dimensions!**)

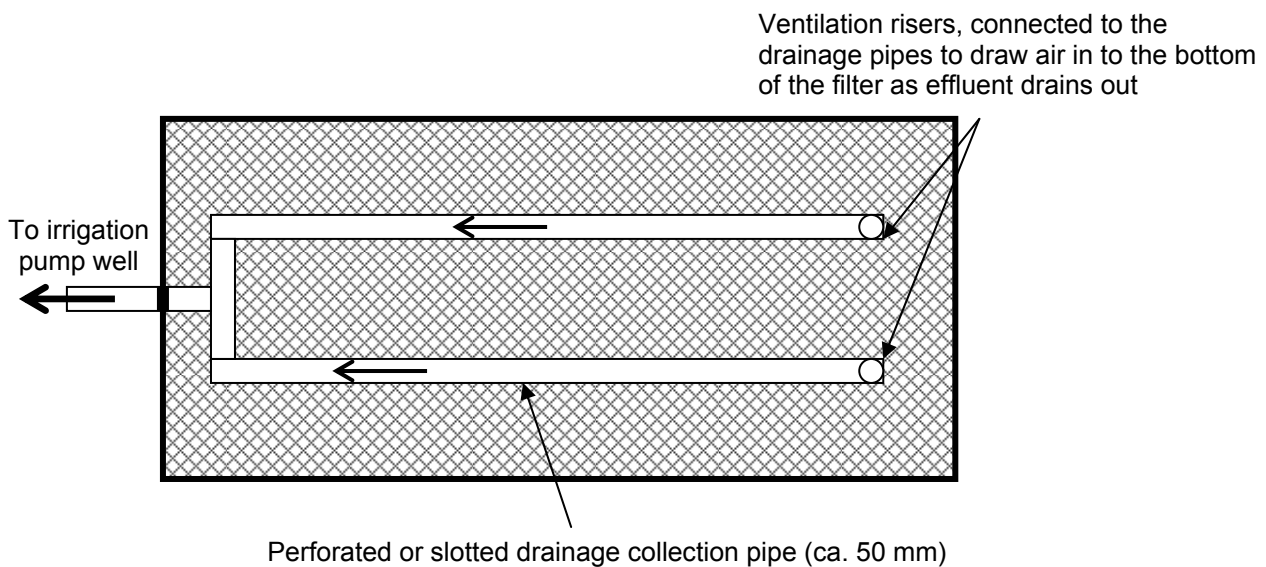


Figure 4: Plan view of effluent collection and passive ventilation system for sand filter. Pipes positioned on bottom of filter bed.