MOYNE SHIRE COUNCIL

FACTSHEET 15: EFFLUENT DISPOSAL – ETA BEDS – EVAPOTRANSPIRATION ABSORPTION BEDS

ETA beds and trenches can be an effective effluent management system in areas with constraining soil textures, limited soil depth, and high water tables. The basic principle of an ETA bed design is to pass the effluent from a septic tank system through a distribution network in a specially prepared mass of suitable sand and gravel layers, and that by capillary action and shallow rooting perennial plants, water is lost by evapotranspiration.

Introduction

Essentially, an ETA bed is a large constructed sponge of sand and gravel, sealed from the surrounding soil, with an inbuilt water storage capacity, and a vegetated surface from which evapotranspiration is maximised.

Figure 1 – Typical ETA configuration.
(Source: Mornington Peninsula Council 2016)

When the base of the bed is used for soil absorption (percolation) of effluent in addition to the evaporative demand of the surface, the system is called an evapotranspiration absorption bed (ETA).

The success of any wastewater system is dependent upon not only the appropriate design and siting of the system, but upon continued vigilance of wastewater quantity and quality in the house, and regular inspections and maintenance of the operating in-field system.

An ETA bed is usually used to dispose of wastewater from a septic tank, but it can also be used to manage secondary treated effluent.

ETA beds are generally unlined beds with some deep seepage. Capillary action draws effluent up through the sand in the upper part of the ETA bed from the storage in the void spaces in the gravel bed beneath.

Effluent is distributed through the bed by a system of slotted pipes.

This supplies the root zone of the vegetation (usually grass) on the top of the bed to optimise evapotranspiration. Vegetation cover must be well maintained to ensure strong growth for maximum uptake by transpiration.

The surrounding landscape and vegetation must also be maintained to minimise shading and maximise exposure.

Absorption beds shall be pressure dosed so that effluent is distributed evenly throughout the length of each bed.

Dosing can be achieved by installing a 25 - 40mm diameter pipe inside each 90mm distribution pipe, with 3-4mm holes drilled in the top of the inner pipe at 300-400mm spacings.

Figure 2 – Cross-section view of ETA bed.
(Source: Mornington Peninsula Council 2016)

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The pipes are then connected at the end of the bed with a flush valve brought to finished ground level. Effluent is pumped through the 25-40mm pipe from the pump chamber and triggered by a float switch.

The dosing pump should create a minimum squirt height (or residual head) of 1.5m at each orifice. The pressure manifold should then be covered with slotted PVC and geo-fabric to prevent blockage, root entry, and bio film build up.

Figure 3 – Pipe-work covered with aggregate and geotextile fabric.
(Source: Mornington Peninsula Council 2016)

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Figure 4 – Raised-bed ETA system.
(Source: University of Illinois 2016)

Design

The ETA bed should be sized according to the recommendations in AS/NZS1547:2012 (see *Figure 5*). The following points should also be considered:

All ETA beds should be designed using hydraulic balance modelling. This will ensure the best bed size and contain construction costs.

The hydraulic balance determines the volume of storage in the gravel bed. This ensures the bed does not overtop in prolonged wet periods when evapotranspiration losses are lower than inputs from rainfall and effluent load. The bed must be turfed immediately following construction.

ETA beds are constructed with a domed upper surface to shed rainfall. The steeper the slope the more rainfall that will be shed. The bed must be located where it will be well exposed to ensure maximum evapotranspiration.

Bedrooms	Daily Flow Rate	Area of Trench/Bed Required (square metres)
2	540 L/day	20
3	720 L/day	25
4	900 L/day	30
5	1080 L/day	35
6	1260 L/day	40

	Typical Dimensions (mm)	Maximum (mm)	Minimum (mm)
Width	3000 – 5000	5000	1000
Depth of Trench	400 – 450	450	400
Depth of Aggregate	300-400	400	300
Depth of Topsoil	100 – 150	150	100

Figure 5 – Required areas and dimensions of ETA's.
(Source: Mornington Peninsula Council 2016)

Installation

A number of installation techniques should be used for effective long term operation of an ETA bed. Common failures of ETA beds are often caused by poor installation practices. Follow the steps below when installing an ETA bed.

Step 1 Site preparation

Locate beds accurately and according to the specified and approved design and/or any covenant.

Step 2 Positioning

Beds must be built along the contours to ensure even distribution and avoid any one part of the bed being more heavily loaded. Failure to do this could lead to premature failure of the most heavily loaded part of the bed, followed by creeping failure as the effluent is forced to more distant parts of the bed.

Avoid cutting beds through existing weakened ground (eg through the alignments of former underground pipes, cables or conduits) as they may provide preferential pathways for effluent to escape from the bed. If these pathways cut downslope through the ground occupied by a series of beds, effluent may preferentially flow to the lowest bed causing it to fail.

Step 3 Timing

Beds should be built in fine weather. If rain does fall before the beds are completed, cover the beds to protect them from rain damage.

Once dug, beds must be completed promptly to avoid foreign material being washed into the open excavation. Puddling (where clay settles at the bottom of a water filled bed left exposed to rain) must be avoided, as the clay on the base of the bed will reduce its performance.

Step 4 Excavation

The base of any bed should be carefully excavated and levelled with a dumpy or laser level. The bed must be level both along and across the line of the bed. Effluent will drain down any slope across the base of the bed and preferentially load the downslope side of the bed, which may then fail.

Where beds are dug along the contour on sloping ground, and by an excavator that does not have a pivoting bucket, the base of the bed will probably be cut parallel to the ground surface. In this case, the base of the bed will have a fall towards the down-slope side.

The bed should be further hand dug to ensure a level base, and to prevent effluent accumulating against the downslope wall of the bed. Where beds are dug by an excavator in more clayey soils, scarify the bed walls to remove any smearing caused by the excavator bucket.

Step 5 Construction

Do not use ETA beds if the soil is dispersive. However, if a degree of dispersiveness is identified after the trenches are dug, add gypsum to the trench base at the rate of one kilogram per square metre. ETA beds are not suitable for heavy clay soils. Ensure that the sides of beds are not damaged or caused to collapse when the beds are filled.

Lay geotextile on top of the gravel media in a bed and beneath the sand to ensure that the sand does not penetrate and block the gravel media. Test piping with clean water before filling with gravel or sand ensures that effluent is evenly and effectively distributed.

Apply 150 millimetres of topsoil to the top of the bed and leave it mounded above the completed bed to allow for settlement and encourage rainfall to run off.

Turf the top of the bed promptly after construction to ensure the best uptake of effluent by evapotranspiration. Ensure that deep rooting trees or shrubs are not planted close to the beds to reduce the chance of roots intruding and clogging the beds. Build a stormwater diversion berm/drain on sloping sites to avoid stormwater filling the ETA bed.

Step 6 Dosing

ETA beds may be gravity-fed or pressure-dosed using pumps or dosing siphons. Where there are shallow soil limiting layers present (eg bedrock or water table), and there is not enough separation distance from such layers, raised pressure-dosed ETA beds are a possible alternative. In these situations, the linear loading rate must also be addressed.

Evapotranspiration / Absorption Bed – Design Specifications

Effluent Pump	Float operated submersible pump with between 20 – 28 metre head and minimum flow rate of 80 litres/minute. A minimum residual head of at least 8 metres at the start of the disposal trenches is required
Pump Line	32mm poly pipe
Dosing/Distribution Pipe	25 – 40mm solid PVC pipe
Distribution Holes	3-4mm holes drilled every 400mm
Manifold	90mm slotted PVC covered with geo-fabric
Screenings	20 - 40mm aggregate, either blue metal or scoria
Reducer	90mm/40mm PVC Stormwater Socket
Flush Return Line	32mm poly pipe
Flush Tap and Junction Box	Suitable for effluent irrigation
In Line Filter	120mm mesh filter (with 50mm thread) suitable for effluent irrigation
Access	Must be housed in junction box with lid at finished ground level OR installed on raised post accessible for regular cleaning

Figure 6 – ETA design specifications.
(Source: Mornington Peninsula Council 2016)

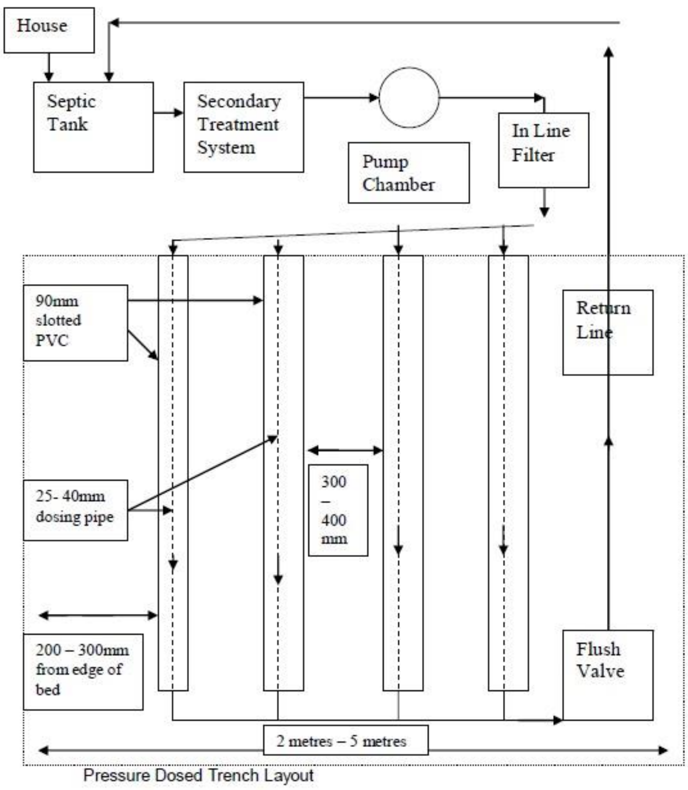

Figure 7 – ETA schematic design specifications.
(Source: Mornington Peninsula Council 2016)

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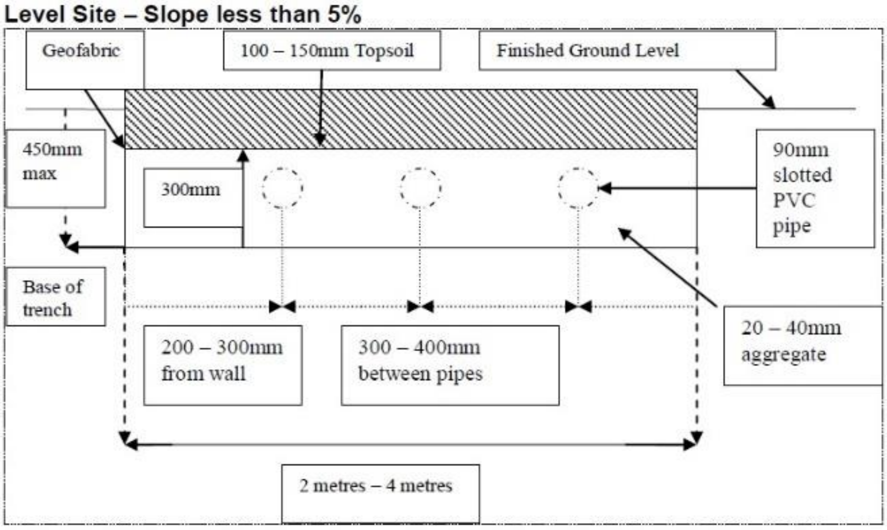

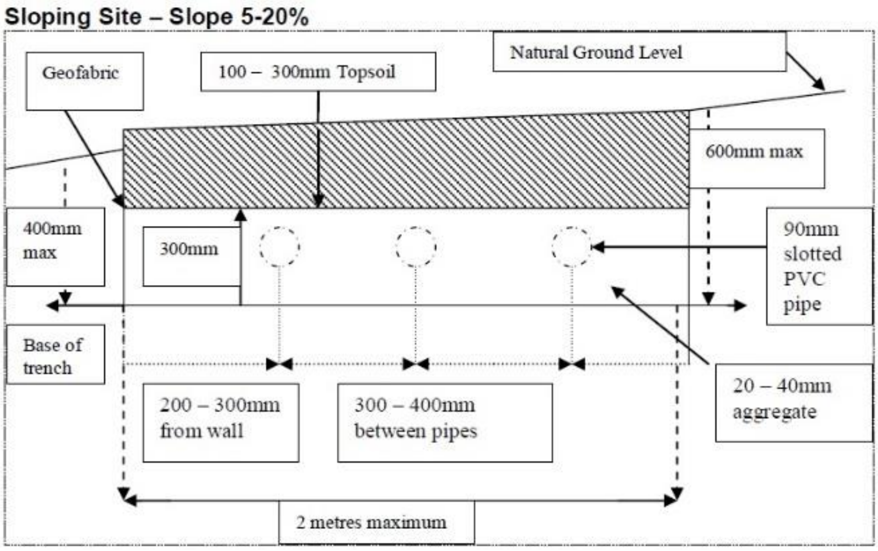

Figures 8 & 9 – ETA schematic design specifications cross-sectional view.
(Source: Mornington Peninsula Council 2016)

For more information see: http://www.epa.vic.gov.au/~/media/Publications/891%204.pdf

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