



SEEC

Wastewater Management: Site & Soil Evaluation & Disposal System Design

**For Proposed Residential Development at: Lot
170 DP 752038 No. 13 Morgan Road, Belrose**

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SEEC Reference: 18000327-P02-WW-02

26 July 2021



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Project Reference: 18000327-P02-WW-02.docx
Date of Assessment: 26/07/2021

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Document Certification

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Document Issue Table

Version	Date	Author	Reviewed	Notes
Draft 0A	19/05/2021	LO	CB	
Draft 0B	20/05/2021	LO	Client	
01 Final	30/06/2021	LO	Client	
02 Final	26/07/2021	LO		

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1 EXECUTIVE SUMMARY

1.1 Scope of Work

Strategic Environmental and Engineering Consulting (SEEC) has been commissioned by David and Jenny Austin, the property owners, to provide this wastewater site assessment. It is required to accompany an application to build a proposed dwelling at Lot 170 DP 752038 No. 13 Morgan Road, Belrose. At the time of assessment there was an existing five-bedroom dwelling onsite which was scheduled for demolition. At the time of inspection there was a horse stable and arena also located onsite (Figure 1). At the time of inspection wastewater generated in the existing dwelling was being secondary treated in an Ultraclear™ ST-10 Aerated Wastewater Treatment System (AWTS) (confirmed by a Highlands Tanks representative) and disposed via absorption beds. Wastewater generated in the existing stables appeared to be directed to an existing 7,800 L septic pump-out tank, although this could not be confirmed. Therefore, this assessment is required to show how treated wastewater generated from the existing dwelling, after additions and alterations, the office and toilet in the stables (domestic wastewater) and wastewater from the stable (agricultural wastewater) can continue to be sustainably managed separately onsite.

1.2 Site Description

Lot 170 DP 752038 is a 2 ha (approx.) rural lot located on the northern side of Morgan Road, Belrose (Figure 1). The proposed dwelling will be located over the footprint of the existing dwelling which is located on the northwestern portion of the Lot, while the existing stables and arena is located in the southern portion of the Lot. The proposed Effluent Management Areas (EMAs) will be located to the south of the existing arena where the site grades at 3% to the south (Figure 1). There are no drainage depressions or dams within prescribed buffers to the EMA. A search of WaterNSW's ground water map did not identify any bores used for potable water within 250 m of the proposed EMA.

Soil investigations revealed 200 mm of pedal greyish brown loamy sand topsoil over weak-moderately pedal grey sandy clay down to 1,100+ mm. Test Pit 2 revealed 200 mm of pedal dark brown sandy loam topsoil over 450 mm of weakly pedal orange/yellow brown clayey sand over 200 mm of weak-moderately pedal brown coarse sandy clay loam over moderately pedal brown coarse sandy clay down to 1,000+ mm. Test Pit 3 revealed 250 mm of pedal brown coarse sandy clay loam topsoil over 350 mm of weakly pedal orange/yellow brown clayey sand over weakly pedal coarse brown sandy clay loam down to 1,000+ mm. Soil chemistry testing revealed the soils are non-acidic but show moderate dispersion potential. Gypsum must be ripped into the base of the new absorption beds at 500 grams per square meter (gsm). Ground disturbance must also be minimised to only what is required for safe and efficient construction of the EMA.

1.3 Proposed Wastewater Management System

1.3.1 Domestic Wastewater

It is proposed to secondary-treat all wastewater generated by the proposed dwelling, the office and toilet in the stable in the existing Ultraclear™ ST-10 AWTs. Secondary-treated effluent will then be pressure-dosed into an EMA made up of new raised absorption beds.

The design loading rate for the raised absorption beds has been based on the weakly pedal Category 4 subsoil encountered in Test Pits 1 and 2. The required bed area is calculated as $1,749/20 = 87.5 \text{ m}^2$. This will be rounded up to 90 m^2 and provided as two $3.22 \text{ m} \times 14 \text{ m}$ beds built end to end, along the contour and to the requirements of AS/NZS1547:2012 (in the area shown in Figure 1 and following the typical details in Figures 2 and 3).

The absorption beds must be raised slightly to ensure they are 200 mm proud of the existing ground surface (Figure 3). Care should be taken to ensure the base of the beds are absolutely level. A two way zone sequencing valve must be installed to alternately dose each bed, if one is not already installed.

1.3.2 Agricultural Wastewater

The stable has seven stalls, a feed room, a tack room, two tie-up stalls and two wash bays. 'Agricultural' wastewater will be generated in the stables. The stable has sealed floors which will be covered with wood shavings or similar organic cover. Equine manure will be removed from the floors and stored in a dedicated area for re-use on the surrounding farmland. Most equine urine will be absorbed by the floor covering and then composted as part of the solid waste train. The storage area for the manure and floor coverings must have a sealed floor to prevent any seepage of excrement in the surrounding soils and be covered at all times to prevent rain ingress. SEEC have been informed by the property owners that twice per year the floor coverings will be removed and the stalls will be washed down with a "Gerni" or similar (i.e. they will not be hosed). Assuming it takes one hour to clean the stalls this is approximately 600 L/wash. This water will be filtered by a solids trap before it drains to the existing 7,800 L septic tank (confirmed by a Highlands Tanks representative), but there will be a small amount of organic matter that flows through. We estimate that would be about 1 kg/stall or say 7 kg/wash or equivalent to 40 g/day.

Each horse will be washed for about 2 minutes 5 days per week using a hose with a trigger nozzle and so each wash is expected to use about 20 L of water. Assuming a maximum of 8 horses are washed, the peak daily horse-wash volume is expected to be approximately $8 \times 20 \text{ L} = 160 \text{ L/day}$. A small additional amount of organic matter will filter through to the septic tank, estimated at another 1 kg/month or 33 g/day.

The peak daily agricultural wastewater load from the stable is estimated at 760 L/day (0.76 m^3) (assuming stalls and horses are washed on the same day). Once in the existing 7,800 L septic tank the effluent will have a long residency time until the next month so it is sufficient to allow for 760 L plus at least 50-60 percent as a factor of safety (say 1,200 L). A sludge allowance must be added to this which is calculated as $0.00455 \times T_s \times DP \times 365^*$ where

Ts = daily solids loading ($0.230 + 0.033 = 0.263$ kg)

DP = de-sludging period (say 3 or 5 years)

This equals 1.31 m^3 for three years or 2.18 m^3 for five years. Therefore, the existing 7,800 L septic tank is of sufficient capacity and can continue to be used to primary-treat all agricultural wastewater generated from the stable. If not already installed, an outlet filter must be installed on the outlet of the septic tank to prevent final solids moving into the existing absorption beds. The cleaning of the stables will only occur once per month (approx.), which means the existing beds can also be used as storage. This would allow a month (approx.) for effluent to drain from the existing beds and into the surrounding soil before the stable is cleaned again. The existing beds have an area of approximately 50 m^2 . Beds of this size will allow for approx. 4.375 m^3 of storage within the aggregate. This is calculated by:

$$\text{Bed area (m}^2\text{)} \times \text{depth of aggregate (m)} \times 25\% = \text{storage volume}$$

$$50 \times 0.35 \times 0.25 = 4.375 \text{ m}^3$$

At the time of inspection the existing beds appeared to be in good working order. Therefore, it is proposed to continue to pressure dose agricultural effluent from the existing septic tank to the existing beds. If not already installed, a pump-well must be installed downslope of the existing septic tank to pressure-dose the existing beds. A two way zone sequencing valve must be installed to alternately dose each bed.

A good cover of vegetation must be established and maintained over the both EMAs.

1.4 Conclusions and Recommendations

We conclude the site is suited to dispose secondary-treated domestic (dwelling, office and toilet in stables) effluent by raised absorption beds and dispose primary-treated agricultural (stable) effluent via the existing beds. Specifically, our recommendations are:

1.4.1 Domestic Wastewater

1. To ensure all domestic wastewater from the proposed dwelling, the office and toilet in the stable drains to the existing Ultraclear™ ST-10 AWTS for secondary treatment;
2. To install at least “four-star” plumbing fixtures, or better, in the proposed additions and alterations to reduce wastewater loads;
3. To ensure no agricultural wastewater is connected to the existing AWTS;
4. To ensure that no other structures (existing or planned) are connected to the existing AWTS unless the proper approval is granted by the Council;
5. To install 90 m^2 of raised absorption beds constructed as two $14 \text{ m} \times 3.22 \text{ m}$ beds built end to end, along the contours and to the requirements of AS/NZS1547:2012 (in the area shown in Figure 1 and following the details in Figures 2 and 3) to dispose secondary-treated wastewater from the AWTS;
6. To rip gypsum into the base of the beds at 500 gsm;

1.4.2 Agricultural Wastewater

7. To ensure all agricultural wastewater from the stables drains to the existing 7,800 L septic tank for primary treatment;
8. To ensure that no other structures (existing or planned) are connected to the existing septic tank unless the proper approval is granted by the Council;
9. To fit an outlet filter onto the outlet of the existing septic tank, if not already installed;
10. To install a pump-well to pressure dose primary-treated effluent into the existing absorption beds, if not already installed;
11. To set aside 50 m² of reserve area in case it is ever required (Figure 1);
12. To provide 50 m² of ETA beds in accordance with AS/NZS1547:2012 (in the area shown in Figure 1 and following the details in Figure 4) if the existing absorption beds show signs of failing and require replacing;

1.4.3 Both

13. To establish and maintain a good cover of vegetation over both the EMAs;
14. To protect the EMAs from vehicle and stock access (fence off if necessary);
15. To ensure all stormwater overflows are directed away from the EMAs
16. To erect a minimum of two Warning Signs along the edge of the EMA. Refer to Section 5.7;
17. To preferentially select low phosphorus, liquid detergents;
18. To only use septic friendly cleaning products; and
19. To install and manage the wastewater system according to the details of this report, its appendices and the manufacturer's recommendations.

Note: This system design might be altered slightly by the Conditions of Consent. It is the responsibility of the owner/builder to check the conditions of consent prior to commencing works.

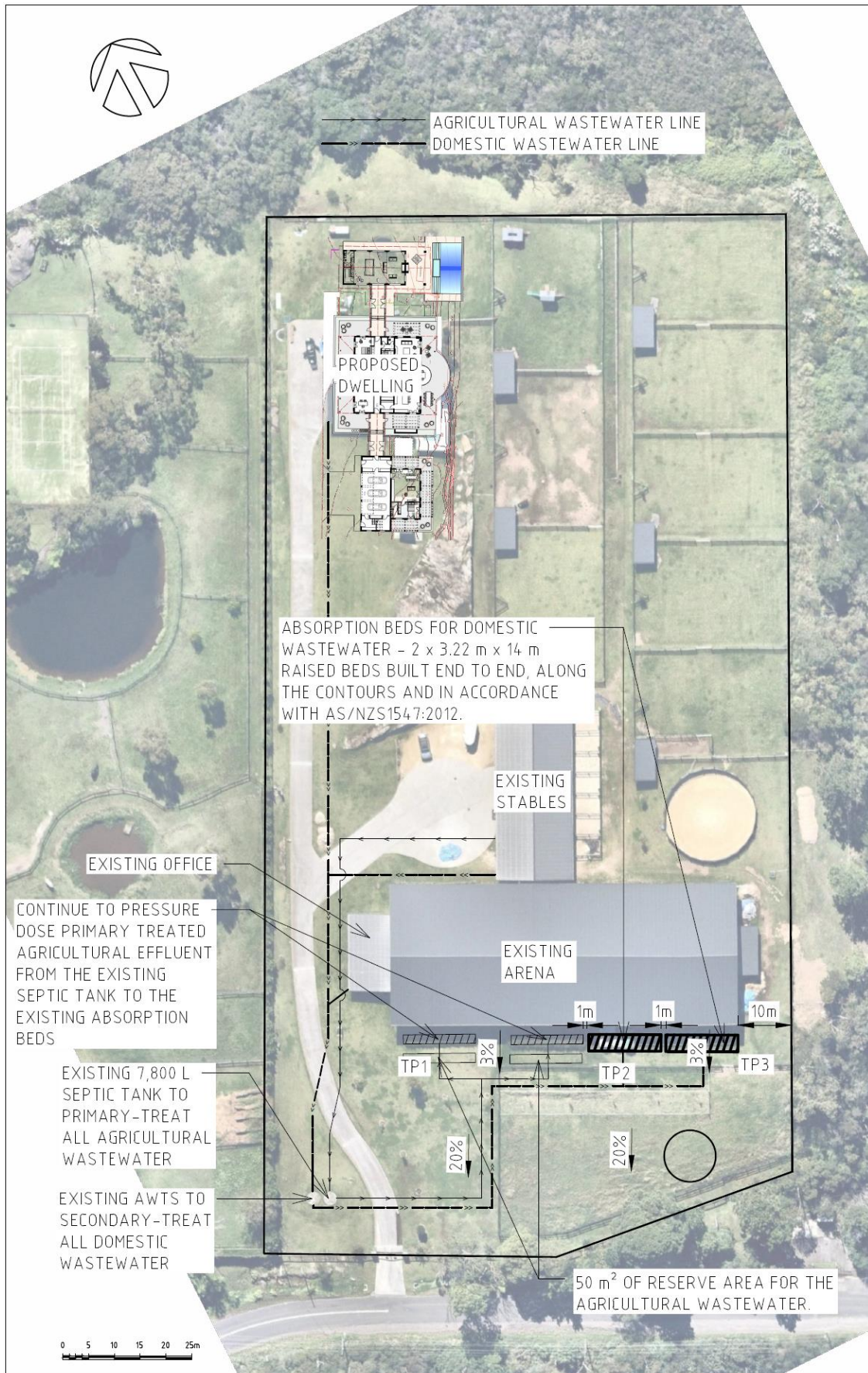


Figure 1 - Site plan and Effluent Management Area. This Figure must be read in conjunction with the accompanying report by SEEC.

2 SITE DETAILS

Table 1 Site details.

Site Address	Lot 170 DP 752038 No. 13 Morgan Road, Belrose
GPS Reading	N. -33.719030 E. 151.224624
Owner	David & Jenny Austin
Owner Address	13 Morgan Road, Belrose
Owner Phone	0419 222 073
Developer	As above
Developer Address	As above
Developer Phone	As above
Allotment Size	2 ha (approx.)
Proposed Development	Amendments and alterations to an existing dwelling
Water Supply	Town/Bore
Number of Potential Bedrooms	6
Local Government Authority	Northern Beaches Shire

Table 2 Design wastewater loading calculations (for a dwelling) (AS/NZS 1547:2012)

Source	Typical wastewater design flows (L/person/day)	
Residential premises	On-site roof tank supply	Reticulated water supply
	120	150

2.1 Design Wastewater Loading

2.1.1 Domestic Wastewater

AS/NZS 1547:2012, Table H1 gives a per person loading of 120L/day or 150L/day for tank water or town water supply respectively. This also assumes that at least three-star rated plumbing appliances are fitted.

After amendments and alterations the existing dwelling will have six-bedrooms. Therefore, the Design Wastewater Loading Rate is 1,350 L/day for the dwelling based on a maximum occupancy of 9 people (AS/NZS 1547:2012).

The design wastewater load for the office and toilet in the stable is estimated using NSW Health Department's "Septic Tank and Collection Well Accreditation Guidelines (2001)". Offices with access to WC, urinal, basin, shower and kitchen have a design load of 43 L/person/day. The toilet in the stable has a design load of 27 L/person/day. SEEC have been informed by the client that office will be used by two-three people, while the toilet in the stable will be used by four people on a daily basis. However, for a week once a month

an additional six people will have access to the toilet in the stable. Therefore the estimated peak load from the office and toilet in the stable is 286 L/day $((10 \times 27) + (3 \times 43) = 399)$.

Therefore the peak domestic wastewater load from the dwelling, office and toilet in the stable is 1,750 L/day $(1,350 + 399 = 1,749)$.

2.1.2 Agricultural Wastewater

The stable complex has seven stalls, feed room, tack room, two tie-up stalls and two wash bays. 'Agricultural' wastewater will be generated in the stables. The stable has sealed floors which will be covered with wood shavings or similar organic cover. Equine manure will be removed from the floors and stored in a dedicated area for re-use on the surrounding farmland. Most equine urine will be absorbed by the floor covering and then composted as part of the solid waste train. The storage area for the manure and floor coverings must have a sealed floor to prevent any seepage of excrement in the surrounding soils and covered at all times to prevent rain ingress. SEEC have been informed by the property owners that twice per year the floor coverings will be removed and the stalls will be washed down with a "Gerni" or similar (i.e. they will not be hosed). Assuming it takes one hour to clean the stalls this is approximately 600 L per wash.

Each horse will be washed for about 2 minutes 5 days per week using a hose with a trigger nozzle and so each wash is expected to use about 20 L of water. Assuming a maximum of 8 horses, the peak daily horse-wash volume is expected to be approximately $8 \times 20 \text{ L} = 160 \text{ L/day}$. A small additional amount of organic matter will filter through to the septic tank, estimated at another 1 kg/month or 33 g/day.

Therefore the peak daily wastewater load from the stable is estimated at 760 L/day (0.76 m^3) (assuming stalls and horses are washed on the same day).

3 PHYSICAL SITE ASSESSMENT

The site and soil evaluation has been undertaken following AS/NZS 1547:2012: *On-site Domestic Wastewater Management*, Sections 2.1 & 2.2 of the *WaterNSW Designing and Installing On-Site Wastewater Systems* (2019) and Appendix 2 of the *Environment & Health Protection Guidelines: On-site Sewage Management for Single Households* (the 'Silver Book', Department of Local Government, 1998).

3.1 Climate

Climate is an important factor in onsite wastewater management. It is particularly important when designing ETA beds as the dual parameters of incidental rainfall and evaporation have a direct effect on the required size. Areas that have high evaporation and low rainfall are better suited to effluent management than those with a cold and/or wet climate. We have found the site is in an area where evaporation exceeds rainfall for most, if not all of, the year.

3.2 Flood Potential

It is required to locate all EMAs above the 1:20 year flood level. This is to reduce the risk of effluent being transported off the site. In addition all electrical components, vents and inspection holes must be located above the 1:100 year flood level. This might involve locating the electrical components remote from the tanks, e.g. on a wall or similar. We are not aware of any flood study having been undertaken on this property. However there does not appear to be any threat of flooding in the proposed EMAs.

3.3 Exposure

Sun and wind exposure on the EMA must be maximised to help with evaporation. Factors that affect this are local topography, vegetation and the built environment. Improper location of an EMA in the shade can reduce evaporation by up to 30 percent. A site investigation conducted by SEEC found that the proposed EMAs are subject to some shading due to the built environment. This will particular affect the EMAs in the winter months as less evaporation of effluent will take place. To minimise wastewater generation on this site SEEC recommend all plumbing fixtures be a minimum four-star rating.

3.4 Slope Gradient

Slope is an important parameter affecting the choice of effluent management systems. Excessive slope increases the risk of effluent leaving the site, particularly during wet weather. It also makes the excavation of absorption or ETA beds difficult as their bases must be level. The values suggested are based on ideal site and soil conditions. If conditions are not ideal we might have adopted a more conservative approach. A site investigation conducted by SEEC found that slopes in the proposed EMAs are between 0 and 10%.

3.5 Landform

Different landforms pose different limitations to effluent management. The risk of run-on and hence the risk of runoff from an EMA is directly related to the type of landform and the position of the EMA on it. A site investigation conducted by SEEC found that the

proposed EMAs are either on a crest or an upper side slope. Therefore, the risk of effluent runoff is considered low.

3.6 Run on and Seepage

Surface stormwater run-on must not be permitted onto an EMA. This is because it could transport effluent offsite and into receiving waters. In addition regular run-on might inhibit vegetative growth. A site investigation conducted by SEEC found that there might be a risk of surface stormwater run-on from structures and water tanks upslope of the EMA. All stormwater overflows must be diverted away from the proposed EMAs.

3.7 Erosion Potential

Sites where there is active erosion must be avoided for effluent management. A site investigation conducted by SEEC found that there are no signs of erosion at this well vegetated site.

3.8 Site Drainage

An EMA must not be placed in wet or damp areas. This is to reduce the risk of effluent leaving the site by either surface waters or groundwater. The type of vegetation and the condition of the soils give good indications of the site's drainage. A site investigation conducted by SEEC found that there are no signs of moisture tolerant vegetation such as sedges, ferns or *Juncus* sp. In addition there are no signs of grey mottling in the subsoils within 500 mm of the surface.

3.9 Fill

The presence of fill might affect the choice of an effluent management system, particularly if very high or very low permeability soils have been imported. Fill might also be prone to settlement and might also be detrimental to the establishment of good vegetative cover. A site investigation conducted by SEEC found that there are signs of fill at this site but either the areas have been avoided or its presence is not considered detrimental to the adopted effluent management system.

3.10 Surface Rock

The presence of frequent rock outcrops or surface rock is usually an indication of shallow and variable soils and/or erosion. Construction of trenches/beds is difficult at such sites and special measures might need to be adopted. A site investigation conducted by SEEC found the site has less than 10 percent rock outcrops.

3.11 Groundwater Use

WaterNSW recommends that EMAs are not located within 100 m from the high water level in bores that are used for domestic potable water. A search of WaterNSW's ground water map did not identify any bores used for potable water within 100 m of the proposed EMA.

3.12 Biodiversity

Treated effluent has the potential to cause adverse harm to sensitive terrestrial biodiversity. According to the Department of Planning, Industry and Environment (DPIE) Biodiversity Values Map and Threshold tool (accessed, 2021) this site is unaffected by any threatened species or communities with potential for serious and irreversible impacts.

3.13 Vegetation

The suitability of the existing vegetation (if any) must be considered. The most common, and one of the most suitable, types of vegetation for effluent management is turf. Turf efficiently covers large areas and provides a good opportunity for evapotranspiration and nutrient uptake (particularly nitrogen). Some native vegetation, particularly that which has developed on poor sandy soils, will not respond well to nutrient-rich wastewater and, if possible, must be avoided or replaced with more suitable species. A site investigation conducted by SEEC found the existing vegetation onsite is improved pasture where the proposed EMAs have a good cover of turf or pasture grasses.

3.14 Proximity to Watercourses

The proximity of natural watercourses or dams is one of the most important factors in the selection of an EMA. It will be necessary to maintain buffers anywhere from 40 m to 100 m between the EMA and a watercourse or dam.

A 40 m buffer is required between an EMA and a drainage depression or a dam, a 100 m buffer is required from a permanent or an intermittent watercourse.

Section 5.4 provides further information on buffer distances.

A site investigation conducted by SEEC found that there are no watercourses or dams within prescribed buffer distances from the proposed EMAs.

3.15 Land Availability

After summarising all of the above, particularly regarding buffer distances, land that is suitable for effluent management on site has been identified. A site investigation conducted by SEEC found that land is limited at this site and has either affected the choice of the most suitable effluent management system and/or has affected the size of the EMAs. Figure 1 identifies the lands that are suitable and unsuitable for effluent management.

3.16 Stock Present

Stock can cause damage to beds and trenches and must be kept out of the EMA by fencing or other physical barrier. A site investigation conducted by SEEC found that there is a risk to the EMAs from stock. The EMAs must be fenced to prevent stock and vehicle access.

3.17 Risk of Frost

Frost can affect the absorption system. All distribution pipes must be well buried to protect them. There is low risk of frost on this site.

4 SOIL ASSESSMENT

The site and soil evaluation has been undertaken following AS/NZS 1547:2012: On-site Domestic Wastewater Management and Appendix 2 of the 'Environment & Health Protection Guidelines: On-site Sewage Management for Single Households (the 'Silver Book', Department of Local Government, 1998).

4.1 Geology and Soil Landscape

The eSPADE mapping (accessed 2021), identifies the site to be on the Lambert Soil Landscape

4.2 Soil Description

4.2.1 Soil Profile Description

Test Pit 1

Layer 1	0	to	200	Pedal greyish brown loamy sand topsoil.
Layer 2	200	to	1,100+	Weak-moderately pedal grey sandy clay. 50mm ribbon.

Test Pit 2

Layer 1	0	to	200	Pedal dark brown sandy loam topsoil.
Layer 2	200	to	650	Weakly pedal orange/yellow brown clayey sand. 10% coarse fragments.
Layer 3	650	to	850	Weak-moderately pedal brown coarse sandy clay loam. 40 mm ribbon.
Layer 4	850	to	1,000+	Moderately pedal brown coarse sandy clay. 60 mm ribbon.

Test Pit 3

Layer 1	0	to	250	Pedal brown coarse sandy clay loam topsoil.
Layer 2	250	to	600	Weakly pedal orange/yellow brown clayey sand. 10% coarse fragments.
Layer 3	600	to	1,000+	Weakly pedal brown coarse sandy clay loam. 40 mm ribbon.

4.2.2 Soil Classification and Design Loading Rate

Table 3 Selected soil classification and corresponding design loading rate.

Soil Category	Soil Texture	Structure	Indicative Permeability		Design Loading Rate (DLR) (mm/day) (AS/NZS 1547:2012)
					Trenches & Beds Secondary
1	Gravels & Sands	Massive	>3.0		
2	Sandy Loams	Weak	>3.0		
		Massive	1.4 - 3.0		
3	Loams	High/ Moderate	1.5 - 3.0		
		Weak or Massive	0.5 - 1.5		
		High/ Moderate	0.5 - 1.5		
4	Clay Loams	Weak	0.12 - 0.5	x	20 for domestic and 8 for agricultural
		Massive	0.06 - 0.12		
5	Light Clays	Strong	0.12 - 0.5		
		Moderate	0.06 - 0.12		
		Weak/ Massive	< 0.06		
6	Medium to Heavy Clays	Strong	0.06 - 0.5		
		Moderate	< 0.06		
		Weak/ Massive	< 0.06		

4.3 Soil Constraints

4.3.1 Soil Depth to a Limiting Layer (e.g bedrock or watertable)

Soil depth is an important factor in choosing a suitable effluent disposal method. The depth of soil is measured to a limiting layer - i.e. bedrock or a periodically high watertable (shown by grey mottling in the soils). Generally, soil is a very good medium for providing treatment to effluent. As the effluent passes through soil it is filtered and there is adsorption of chemicals (particularly phosphorous) onto the soil particles. In addition, the time taken to pass through the soil provides time for viruses to die. At least 600 mm of soil is required under beds or trenches dosed with primary-treated effluent. This can be reduced to 300 mm for secondary effluent but a check must be made of the linear loading rate. A site investigation conducted by SEEC found the soil depth is more than 1.0 m. Depending on its permeability disposal of primary treated effluent in either beds or trenches is permissible.

4.3.2 Coarse Fragments

Coarse fragments are those over 2 mm in diameter. They can pose limitations to vegetative growth by lowering the soil's ability to supply water and nutrients. A site investigation conducted by SEEC found there are less than 20 percent coarse fragments present.

4.3.3 pH of Soils

The pH of a soil influences its ability to supply nutrients to vegetation. If the soil is too acidic vegetative growth would be inhibited. A site investigation conducted by SEEC found the pH of the soil is more than 6.0. This is unlikely to inhibit vegetative growth.

4.3.4 *Electrical Conductivity*

The electrical conductivity of the soil relates to the amount of salts present. A high salt concentration would inhibit vegetative growth. Electrical conductivity has been measured in deciSemens per metre (dS/m). We have found the electrical conductivity of the soil is less than 4 dS/m. This is unlikely to inhibit vegetative growth.

4.3.5 *Emerson Aggregate Test (EAT)*

The Emerson Aggregate Test (EAT) is a measure of soil dispersibility and susceptibility to erosion. It assesses the physical changes that occur to a single ped of soil when immersed in water - specifically whether it slakes and falls apart or disperses and clouds the water. We have classed the soil as Class 2 which means that the soils show minor dispersion potential but the land is well vegetated and this will minimise excessive erosion if the vegetation is maintained. Gypsum must be ripped into the base of the new absorption beds

4.3.6 *Phosphorus Sorption*

The capacity of a soil to adsorb phosphorus is expressed as its phosphorus sorption capacity. Soils with a high capacity to sorb phosphorous are preferred and can result in smaller application areas. Phosphorous sorption values were sourced from WaterNSW, 2019.

TOPSOIL Estimated P-Sorp (mg/kg) = 100

SUBSOIL Estimated P-Sorp (mg/kg) = 400-500

5 RECOMMENDATIONS

Note: This system design might be altered slightly by the Conditions of Consent. It is the responsibility of the owner/builder to check the conditions of consent prior to commencing works.

5.1 Wastewater System

5.1.1 Domestic Wastewater

The following disposal method has been chosen by the client and/or is considered the most suitable for domestic wastewater:

Raised absorption Beds following treatment in the existing Ultraclear ST-10 AWTS.

5.1.2 Agricultural Wastewater

The following disposal method has been chosen by the client and/or is considered the most suitable for agricultural wastewater:

Existing absorption beds following treatment in the existing 7,800 L septic tank.

5.2 Sizing of the Disposal System

AS/NZS 1547:2012 provides a formula to be used to calculate the required area of the bed(s). The formula to calculate the required area of bed(s) is: Required area = wastewater load/ DLR. The DLR from section 4.2.2 is adopted in the calculations. Note that the maximum recommended width of an absorption bed is 4 m and the maximum recommended length is 20 m. This is to ensure even application of effluent over the base. However, if the beds are pressure dosed (i.e. from a pump well or an AWTS) these conditions may be relaxed.

The required bed area is calculated as $1,786/20 = 89.3 \text{ m}^2$. This will be rounded up to 90 m^2 and provided as two $3.22 \text{ m} \times 14 \text{ m}$ beds built end to end, along the contour and to the requirements of AS/NZS1547:2012 (in the area shown in Figure 1 and following the typical details in Figures 2 and 3).

AS/NZS 1547:2012 provides a formula to be used to calculate the required area of the ETA bed(s). The formula to calculate the required area of ETA bed(s) is: Required area = wastewater load/ DLR. The DLR from section 4.2.2 is adopted in the calculations.

5.3 Professional Construction

A licensed plumber familiar with the design of wastewater disposal systems must be employed to install the disposal system. A combination of manual and/or automatic switching valves will be used to help switch the wastewater flow between the different beds as required. If effluent is pressure dosed, non-return valves must be fitted and buried at a depth of 300 mm or 500 mm under an access way, and laid in a manner to protect from machinery damage or deformation.

5.4 Buffer Distances

Buffer distances from land applications systems as specified by NSW DLG (2012) are outlined in table 4.

Table 4 Specified Buffer Distances.

All Absorption Systems	100 m to permanent water features 40 m to intermittent water features and farm dams 250 m to potable water bores	
	Primary	12 m if area upslope and 6 m if area downslope of property boundaries 6 m if area upslope and 3 m if area downslope of swimming pools, driveways and buildings.
	Secondary	6 m if area upslope and 3 m if area downslope of property boundaries 6 m if area upslope and 3 m if area downslope of swimming pools, driveways and buildings.

Refer to Figure 1 for the recommended positioning of the EMA.

5.5 Detergent Use

Liquid detergents must be used in the household as powders contain elevated concentrations of salt which could alter the soil's chemistry and reduce its ability to percolate water. All cleaning products must be "Septic Friendly".

5.6 Water Saving Fixtures

This design assumes at least four-star rated plumbing fixtures are used in any structure on this site.

5.7 Signs

A minimum of two Warning Signs must be installed along the edge of the EMA. The signs shall read "WARNING: RECLAIMED EFFLUENT/RECYCLED WATER, DO NOT DRINK, AVOID CONTACT" or similar. Lettering must be clearly visible from three meters away.

5.8 Summary of Recommendations

We conclude the site is suited to dispose secondary-treated domestic (dwelling, office and toilet in stables) effluent by raised absorption beds and dispose primary-treated agricultural (stable) effluent via the existing beds. Specifically, our recommendations are:

5.8.1 Domestic Wastewater

1. To ensure all domestic wastewater from the proposed dwelling, the office and toilet in the stable drains to the existing Ultraclear™ ST-10 AWTS for secondary treatment;
2. To install at least "four-star" plumbing fixtures, or better, in the proposed additions and alterations to reduce wastewater loads;

3. To ensure no agricultural wastewater is connected to the existing AWTS;
4. To ensure that no other structures (existing or planned) are connected to the existing AWTS unless the proper approval is granted by the Council;
5. To install 90 m² of raised absorption beds constructed as two 14 m x 3.22 m beds built end to end, along the contours and to the requirements of AS/NZS1547:2012 (in the area shown in Figure 1 and following the details in Figures 2 and 3) to dispose secondary-treated wastewater from the AWTS;
6. To rip gypsum into the base of the beds at 500 gsm;

5.8.2 *Agricultural Wastewater*

7. To ensure all agricultural wastewater from the stables drains to the existing 7,800 L septic tank for primary treatment;
8. To ensure that no other structures (existing or planned) are connected to the existing septic tank unless the proper approval is granted by the Council;
9. To fit an outlet filter onto the outlet of the existing septic tank, if not already installed;
10. To install a pump-well to pressure dose primary-treated effluent into the existing absorption beds, if not already installed;
11. To set aside 50 m² of reserve area in case it is ever required (Figure 1);
12. To provide 50 m² of ETA beds in accordance with AS/NZS1547:2012 (in the area shown in Figure 1 and following the details in Figure 4) if the existing absorption beds show signs of failing and require replacing;

5.8.3 *Both*

13. To establish and maintain a good cover of vegetation over both the EMAs;
14. To protect the EMAs from vehicle and stock access (fence off if necessary);
15. To ensure all stormwater overflows are directed away from the EMAs
16. To erect a minimum of two Warning Signs along the edge of the EMA. Refer to Section 5.7;
17. To preferentially select low phosphorus, liquid detergents;
18. To only use septic friendly cleaning products; and
19. To install and manage the wastewater system according to the details of this report, its appendices and the manufacturer's recommendations.

6 SYSTEM DESIGN

Note: This system design might be altered slightly by the Conditions of Consent. It is the responsibility of the owner/builder to check the conditions of consent prior to commencing works.

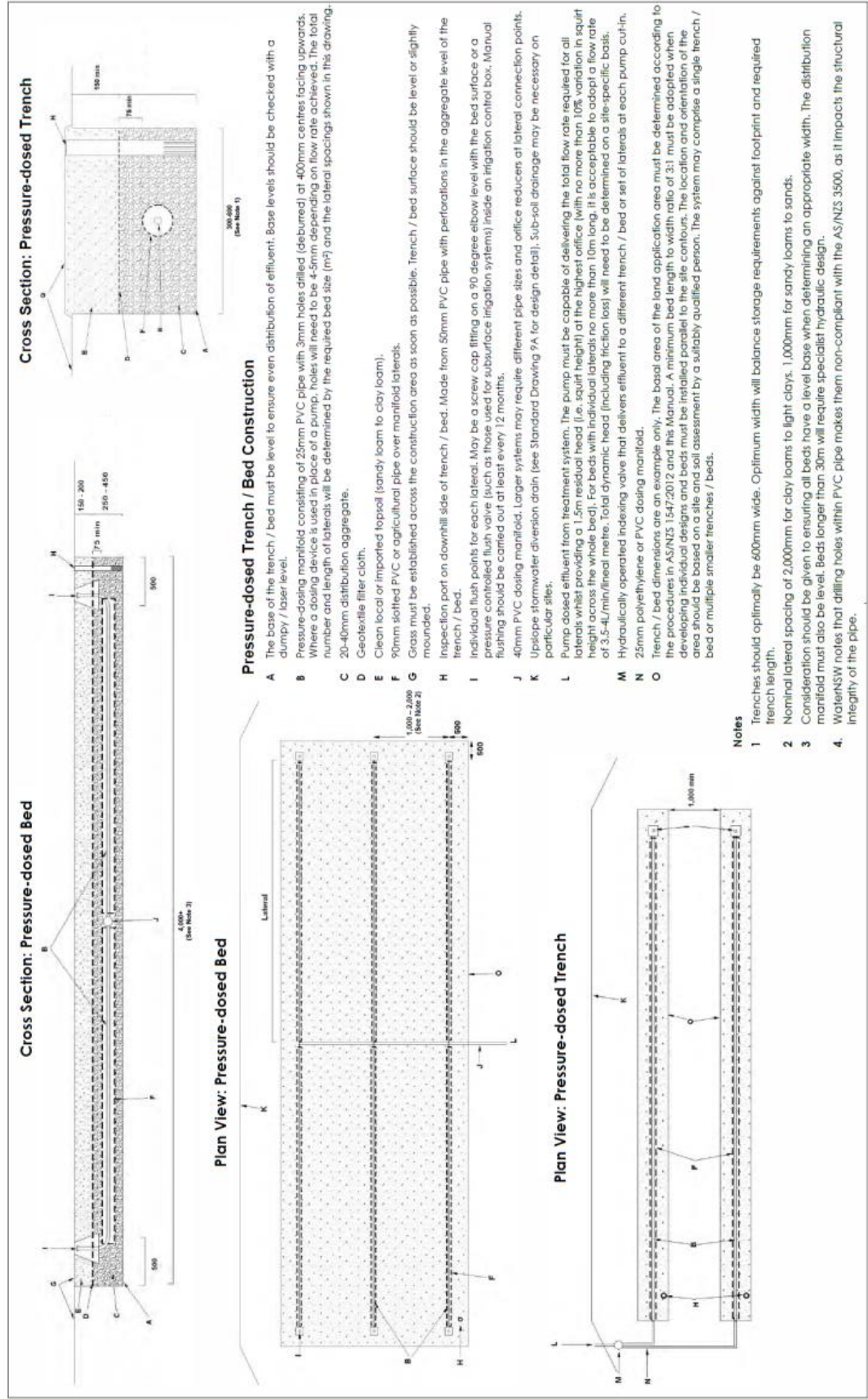
This design assumes a certain design wastewater load. It will be invalidated if that load were to significantly increase (>10 percent): This might occur due to (but not limited to):

- If a spa bath or in-sink food grinder were installed.
- If a home is occupied by more than 2 persons per bedroom.
- If water fixtures are not at least three-star rated.
- If plumbing leaks are not attended to.

The design is warranted to meet the required design guidelines and standards at the time of writing. However, that does not preclude the requirement of the land owner to satisfactorily use and maintain the system to the requirements of the manufacturers and to the generic guidelines given in the following Appendix. In particular there are requirements to:

- Ensure that only “septic-friendly” substances are disposed into the system (materials and chemicals).
- Periodically (once per 3-5 years) clean out the septic tank or septic chamber of the AWTS.
- Regularly (once per three months) clean the septic outlet filter or the in-line filter.
- Regularly (once per three months) manually flush the system.
- Periodically (one per year) check the disposal area for signs of seepage.
- Periodically (one per year) check the upslope diversion drain (if applicable) to ensure stormwater is adequately diverted.

Your system will be inspected as required by Council. The Wastewater Contractor must inspect both the treatment system and the disposal area following the checklist given in Appendix 1 and submit the results to Council. Should there be a problem with your system you must initially consult the licensed contractors who installed the system and/or your regular maintenance contractor.



Standard Drawing 10C – Pressure-dosed Bed / Trench

(not to scale)

Figure 2 – Proposed Disposal System (Typical details). This Figure must be read in conjunction with the accompanying report by SEEC.

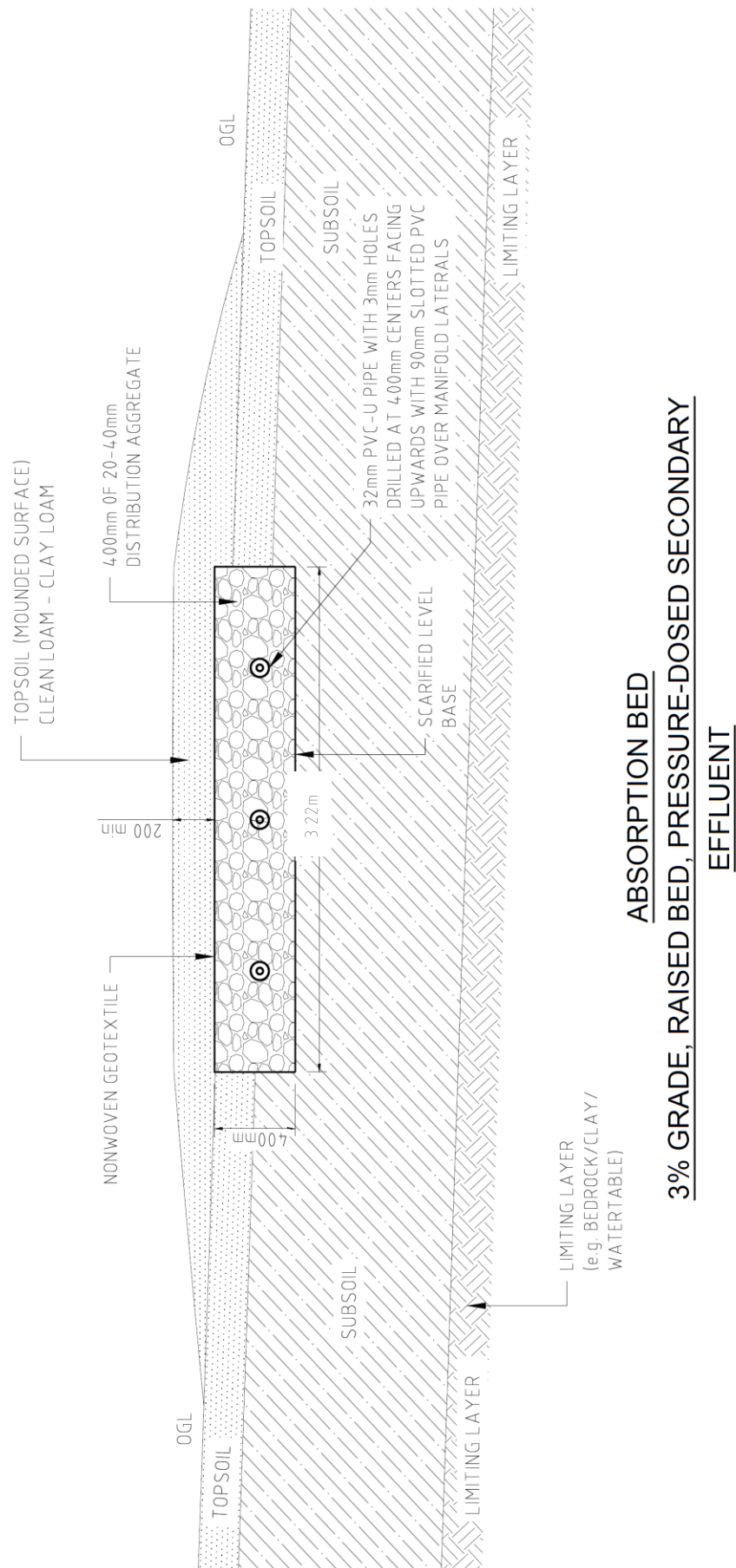
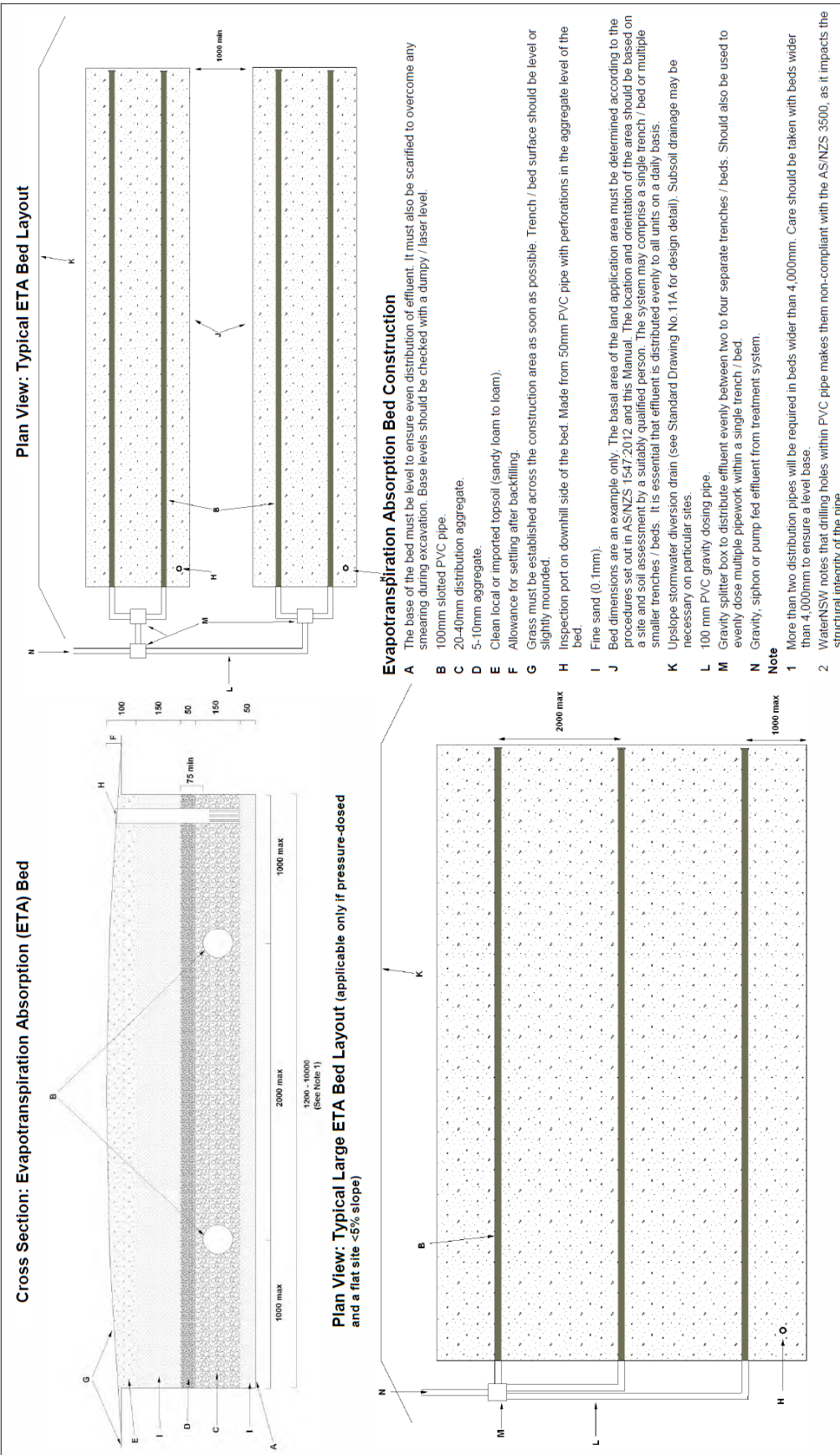


Figure 3 - Cross-section of raised absorption bed (Typical details). This Figure must be read in conjunction with the accompanying report by SEEC.



Standard Drawing 11B – Evapotranspiration Absorption Bed
(not to scale)

Figure 4 – Proposed Disposal System (Typical details). This Figure must be read in conjunction with the accompanying report by SEEC.

7 REFERENCES

Department of Local Government (1998). Environment and Health Protection Guidelines: *Onsite Sewage Management for Single Household*.

eSPADE (2021). NSW Office of Environment and Heritage.

Standards Australia / Standards New Zealand (2012). AS/NZS 1547:2012 *On-site Domestic Wastewater Management*.

WaterNSW (2019), *Designing and Installing On-Site Wastewater Systems. A WaterNSW Current Recommended Practice*.

8 APPENDICES

8.1 Appendix 1 – Annual Checklist for Owners (WaterNSW, 2019)

Checklist 10.2 Operation of trenches and beds for use by plumbers, Council inspectors and system owners	Checklist 11.2 Operation of ETA beds for use by plumbers, Council inspectors and system owners
Site owner:	Owner name:
Address:	Address:
Installation date:	Installation date:
Trench / bed coordinates:	ETA bed coordinates:
Is there evidence of surface water or soggy ground on the trench / bed area (e.g. after emptying a bath)? ☐ Yes ☐ No	Is there evidence of surface water or soggy ground on the trench / bed area (e.g. after emptying a bath)? ☐ Yes ☐ No
Are some trenches or beds greener than others? ☐ Yes ☐ No	Are some areas of the ETA bed(s) greener than others? ☐ Yes ☐ No
Is there evidence of stormwater intrusion? ☐ Yes ☐ No	Is there evidence of stormwater intrusion? ☐ Yes ☐ No
Is there any indication that water on the surface of the trench or bed is effluent? ☐ Yes ☐ No	Is there any indication that water on the surface of the trench or bed is effluent? ☐ Yes ☐ No
Is there evidence of vehicle, human or animal traffic over the trench / bed area? ☐ Yes ☐ No	Is there an indication of poor drainage on or near the bed area? ☐ Yes ☐ No
Is there evidence of protective measures to prevent trench / bed damage (e.g. shrubs, fencing)? ☐ Yes ☐ No	Is there evidence of vehicle, human or animal traffic over the trench / bed area? ☐ Yes ☐ No
Is a good vegetation cover established over the trench / bed surface? ☐ Yes ☐ No	Is there evidence of protective measures to prevent trench / bed damage (e.g. shrubs, fencing)? ☐ Yes ☐ No
Does the trench / bed have good exposure to wind and sun? ☐ Yes ☐ No	Is a good vegetation cover established over the trench / bed surface? ☐ Yes ☐ No
Are the inspection port interiors clear (i.e. no standing water suggesting trench flooding) and in good condition? ☐ Yes ☐ No	Does the trench / bed have good exposure to wind and sun? ☐ Yes ☐ No
Is the dosing device or splitter box working properly and not blocked or clogged? ☐ Yes ☐ No	Are the inspection port interiors clear (i.e. no standing water suggesting trench flooding) and in good condition? ☐ Yes ☐ No
Is any pump is operating correctly? ☐ Yes ☐ No	Is the dosing siphon or splitter box working properly and not blocked or clogged? ☐ Yes ☐ No
Is the control system set correctly to deliver appropriate volumes of effluent to specific irrigation fields according to the hydraulic design? ☐ Yes ☐ No	Is any pump or siphon operating correctly? ☐ Yes ☐ No
Are regular desludges of the tank undertaken? ☐ Yes ☐ No	Is the control system set correctly to deliver appropriate volumes of effluent to specific irrigation fields according to the hydraulic design? ☐ Yes ☐ No
Has the septic tank outlet filter been cleaned by way of hosing the filter off? ☐ Yes ☐ No	Are regular desludges of the tank undertaken? ☐ Yes ☐ No
Service provider: Contact number:	Has the septic tank outlet filter been cleaned by way of hosing the filter off? ☐ Yes ☐ No
Comments or repairs needed: (Where a response in the above Checklist needs extra information or action, specify the action plan and/or the process to fix the problem, or specify an alternative that is being offered)	Service provider: Contact number:
Name / title of inspector:	Comments or repairs needed: (Where a response in the above Checklist needs extra information or action, specify the action plan and/or the process to fix the problem, or specify an alternative that is being offered)
Signature:	Name / title of inspector:
Date:	Signature:
	Date:

8.2 Appendix 2 – Fact Sheets for Owners

Managing Wastewater In Your Backyard

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your septic system. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system contaminating groundwater or a nearby waterway.

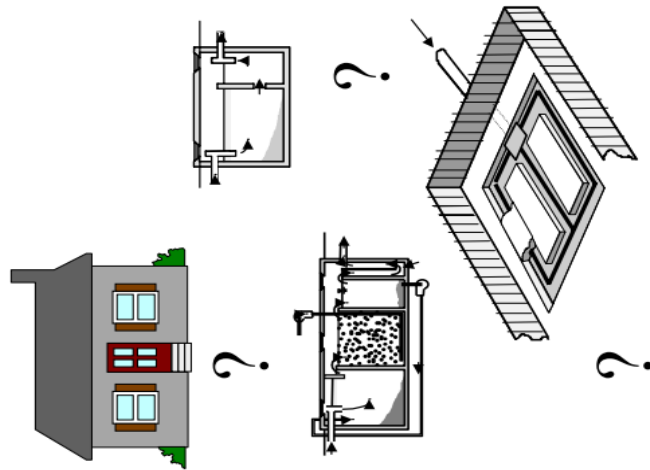
Your sewage management system is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained sewage management systems are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your management system you can do your part in helping to protect the environment and the health of you and your community.

For more information please contact:



DO

- ✓ Learn how your sewage management system works and its operational and maintenance requirements.
- ✓ Learn the location and layout of your sewage management system.
- ✓ Have your AWTs (if installed) inspected and serviced four times per year by an approved contractor. Other systems should be inspected at least once every year. Assessment should be applicable to the system design.
- ✓ Keep a record of desludgings, inspections, and other maintenance.
- ✓ Have your septic tank or AWTs desludged every three years to prevent sludge build up, which may 'clog' the pipes.
- ✓ Conserve water. Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.
- ✓ Discuss with your local council the adequacy of your existing sewage management system if you are considering house extensions for increased occupancy.

DON'T

- ✗ Don't let children or pets play on land application areas.
- ✗ Don't water fruit and vegetables with effluent.
- ✗ Don't extract untreated groundwater for cooking and drinking.
- ✗ Don't put large quantities of bleaches, disinfectants, whiteners, nappy soakers and spot removers into your system via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't install or use a garbage grinder or spa bath if your system is not designed for it.

ON-SITE SEWAGE MANAGEMENT SYSTEMS

If you live in or rent a house that is not connected to the main sewer then chances are that your yard contains an on-site sewage management system. If this is the case then you have a special responsibility to ensure that it is working as well as it can.

The aim of this pamphlet is to introduce you to some of the most popular types of on-site sewage management systems and provide some general information to help you maintain your system effectively. You should find out what type of system you have and how it works.

More information can be obtained from the pamphlets:

Your Septic System
Your Aerated Wastewater Treatment System
Your Composting Toilet
Your Land Application Area

You can get a copy of these pamphlets from your local council or the address marked on the back of this pamphlet.

It is important to keep in mind that maintenance needs to be performed properly and regularly. Poorly maintained on-site sewage management systems can significantly affect you and your family's health as well as the local environment.

What is an on-site sewage management system?

A domestic on-site sewage management system is made up of various components which - if properly designed, installed and maintained - allow the treatment and utilisation of wastewater from a house, completely within the boundary of the property.

Wastewater may be blackwater (toilet waste), or greywater (water from showers, sinks, and washing machines), or a combination of both.

Partial on-site systems - eg. pump out and common effluent systems (CES) - also exist. These usually involve the preliminary on-site treatment of wastewater in a septic tank, followed by collection and transport of the treated wastewater to an off-site management facility. Pump out systems use road tankers to transport the effluent, and CES use a network of small diameter pipes.

How does an on-site sewage management system work?

For complete on-site systems there are two main processes:

1. treatment of wastewater to a certain standard
2. its application to a dedicated area of land.

The type of application permitted depends on the quality of treatment, although you should try to avoid contact with all treated and untreated wastewater, and thoroughly wash affected areas if contact does occur.

Treatment and application can be carried out using various methods:

Septic Tank

Septic tanks treat both greywater and blackwater, but they provide only limited treatment through the settling of solids and the flotation of fats and greases. Bacteria in the tank break down the solids over a period of time. Wastewater that has been treated in a septic tank can only be applied to land through a covered soil absorption system, as the effluent is still too contaminated for above ground or near surface irrigation.

AWTS

Aerated wastewater treatment systems (AWTS) treat all household wastewater and have several treatment compartments. The first is like a septic tank, but in the second compartment air is mixed with the wastewater to assist bacteria to break down solids. A third compartment allows settling of more solids and a final chlorination contact chamber allows disinfection. Some AWTS are constructed with all the compartments inside a single tank. The effluent produced may be surface or sub-surface irrigated in a dedicated area.

Composting Toilets

Composting toilets collect and treat toilet waste only. Water from the shower, sinks and the washing machine needs to be treated separately (for example in a septic tank or AWTS as above). The compost produced by a composting toilet has special requirements but is usually buried on-site.

There are just some of the treatment and application methods available, and there are many other types such as sand filter beds, wetlands, and amended earth mounds. Your local council or the NSW Department of Health have more information on these systems if you need it.

Regulations and recommendations

The NSW Department of Health determines the design and structural requirements for treatment systems for single households. Local councils are primarily responsible for approving the installation of smaller domestic septic tank systems, composting toilets and AWTSs in their area, and are also responsible for approving land application areas. The NSW Environment Protection Authority approves larger systems.

The design and installation of on-site sewage management systems, including plumbing and drainage, should only be carried out by suitably qualified or experienced people. Care is needed to ensure correct sizing of the treatment system and application area.

Heavy fines may be imposed under the Clean Waters Act if wastewater is not managed properly.

Keeping your on-site sewage management system operating well

What you put down your drains and toilets has a lot to do with how well your system performs. Maintenance of your sewage management system also needs to be done well and on-time. The following is a guide to the types of things you should and should not do with your system.

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your AWTs. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system entering a nearby river, creek or dam.

Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.

Your AWTs is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

Warning signs

You can look out for a few warning signs that signal to you that there are troubles with your AWTs. Ensure that these problems are attended to immediately to protect your health and the environment.

Look out for the following warning signs:

- ⚠ Water that drains too slowly.
- ⚠ Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- ⚠ Sewage smells, this indicates a serious problem.
- ⚠ Water backing up into your sink which may indicate that your system is already failing.
- ⚠ Wastewater pooling over the land application area.
- ⚠ Black coloured effluent in the aerated tank.
- ⚠ Excess noise from the blower or pumping equipment
- ⚠ Poor vegetation growth in irrigated area.

Odour problems from a vent on the AWTs can be a result of slow or inadequate breakdown of solids. Call a technician to service the system.

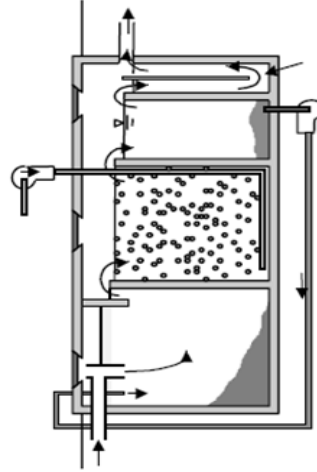
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained AWTs are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your treatment system you can do your part in helping to protect the environment and the health of you and your family.

If you would like more information please contact:

Your Aerated Wastewater Treatment System



Aerated Wastewater Treatment Systems (AWTS)

In unsewered areas, the proper treatment and utilisation of household wastewater on-site is critical in preserving the health of the public and the environment. AWTS have been developed as a way of achieving this.

What is an AWTS?

An AWTS is a purpose built system used for the treatment of sewage and liquid wastes from a single household or multiple dwellings.

It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

How does an AWTS work?

Wastewater from a household is treated in stages in several separate chambers. The first chamber is similar to a conventional septic tank. The wastewater enters the chamber where the solids settle to the bottom and are retained in the tank forming a sludge layer. Scum collects at the top, and the partially clarified wastewater flows into a second chamber. Here the wastewater is mixed with air

to assist bacteria to further treat it. A third chamber allows additional clarification through the settling of solids, which are returned for further treatment to either the septic chamber (as shown) or to the aeration chamber. The clarified effluent is disinfected in another chamber (usually by chlorination) before irrigation can take place.

Bacteria in the first chamber break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the chamber and must be pumped out periodically.

Regulations and recommendations

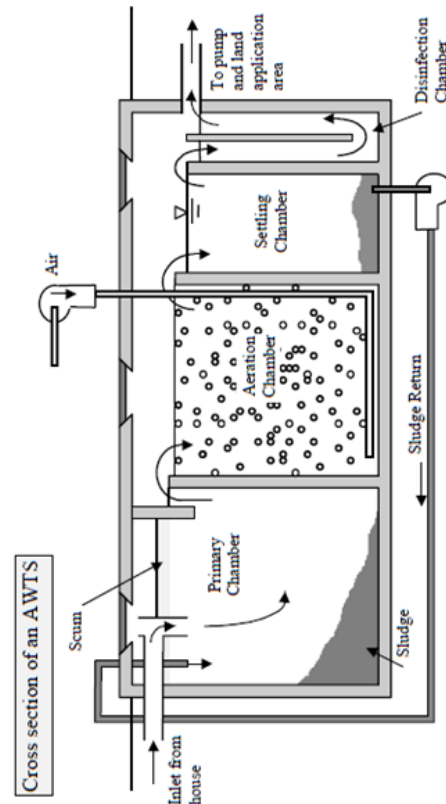
Local councils are primarily responsible for approving the smaller, domestic AWTSs in their area. The Environment Protection Authority (EPA) approves larger units, whilst the NSW Department of Health determines the design and structural requirements for all AWTSs.

At present AWTSs need to be serviced quarterly by an approved contractor at a cost to the owner. Local councils should also maintain a register of the servicing of each system within their area.

AWTSs should be fitted with an alarm having visual and audible components to indicate mechanical and electrical equipment malfunctions. The alarm should provide a signal adjacent to the alarm and at a relevant position inside the house. The alarm should incorporate a warning lamp which may only be reset by the service agent.

Maintaining your AWTS

The effectiveness of the system will, in part, depend on how it is used and maintained. The following is a guide on good maintenance procedures that you should follow:



DO

- ✓ Have your AWTS inspected and serviced four times per year by an approved contractor. Assessment should be applicable to the system design.
- ✓ Have your system service include assessment of sludge and scum levels in all tanks, and performance of irrigation areas.
- ✓ Have all your tanks desludged at least every three years.
- ✓ Have your disinfection chamber inspected and tested quarterly to ensure correct disinfectant levels.
- ✓ Have your grease trap (if installed) cleaned out at least every two months.
- ✓ Keep a record of pumping, inspections, and other maintenance.
- ✓ Learn the location and layout of your AWTS and land application area.
- ✓ Use biodegradable liquid detergents such as concentrates with low sodium and phosphorous levels.
- ✓ Conserve water.

DON'T

- ✗ Don't put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into your AWTS via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't use more than the recommended amounts of detergents.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't switch off power to the AWTS, even if you are going on holidays

DON'T

- ✗ Don't put large quantities of bleaches, disinfectants, whiteners, nappy soakers and spot removers into your septic tank via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't use more than the recommended amounts of detergents.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't install or use a garbage grinder or spa bath if your system is not designed for it.

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your septic system. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system contaminating groundwater or a nearby river, creek or dam.

Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.

Your septic system is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

Warning signs

You can look out for a few warning signs that signal to you that there are troubles with your septic tank. Ensure that these problems are attended to immediately to protect your health and the environment.

Look out for the following warning signs:

- ⚠ Water that drains too slowly.
- ⚠ Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- ⚠ Sewage smells, this indicates a serious problem.
- ⚠ Water backing up into your sink which may indicate that your septic system is already failing.
- ⚠ Wastewater surfacing over the land application area.

Trouble shooting guide

If there are odours check the following areas:

- ⚠ Greasetrapp (if installed), is it full or blocked?
- ⚠ Absorption field, is it wet or soggy?
- ⚠ Has there been recent heavy rain?

Odour problems from a vent on the septic system can be a result of slow or inadequate breakdown of solids. Call a technician to service the system.

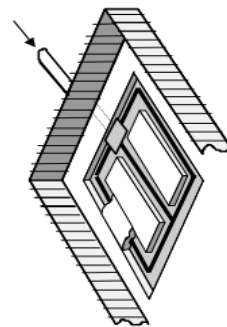
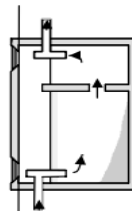
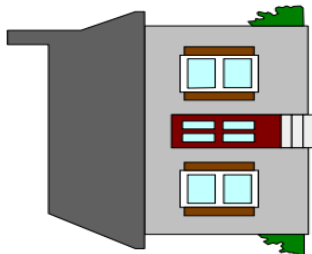
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained septic tanks are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your septic system you can do your part in helping to protect the environment and the health of you and your family.

If you would like more information please contact:

Your Septic System



SEPTIC SYSTEMS

In unsewered areas, the proper treatment and reuse of household wastewater on-site is critical in ensuring minimal impact to public health and the environment. Septic systems have been developed as a way of achieving this.

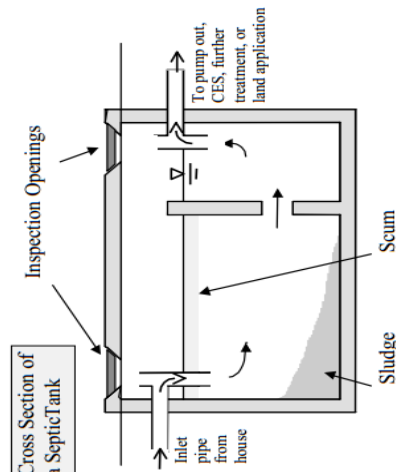
What is a septic system?

A septic system consists of a septic tank combined with a soil absorption system and/or transpiration beds or pump out connections. The system enables people living in unsewered areas to treat and disperse their sewage.

A septic tank is a structurally sound watertight tank used for the treatment of sewage and liquid wastes from a single household or multiple dwellings.

How does a septic system work?

All the wastewater from a household enters the tank. Most of the solids settle to the bottom and are retained in the tank forming a sludge layer, whilst fats and greases collect at the top in a scum layer.

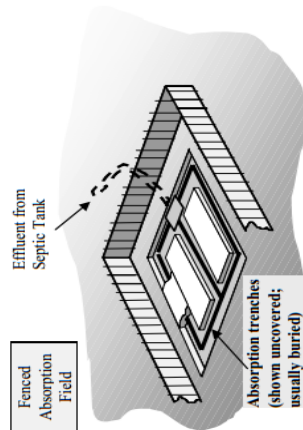


Bacteria in the septic tank break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the tank and must be pumped out periodically.

There are three ways to handle septic tank effluent:

On-site application. The effluent flows from the septic tank to transpiration and/or absorption trenches. Here the effluent is mainly absorbed into the soil and partly evaporated by the sun and used by vegetation.

Such application systems have the potential to contaminate groundwater and are not recommended in sensitive locations or in higher density developments. Further treatment followed by subsurface irrigation should be considered.



Pump out. The effluent flows from the septic tank into a collection well or holding tank. At regular periods, a tanker pumps out the holding tank and transports the effluent to an off-site management facility.

Common effluent system (CES). The treated wastewater is transported to an off-site management facility through a network of small diameter pipes.

Regulations and recommendations

An on-site septic system requires approval from the local council before it is put in place. The regulations that apply to single household systems differ from those for multiple dwellings. The Environment Protection Authority (EPA) is responsible for approving septic tanks used to treat wastes generated by multiple dwellings like caravan parks and commercial and industrial premises. The NSW Department of Health determines the design and structural requirements for septic tanks and collection wells.

Local councils have the authority to approve systems certified by the NSW Department of Health for individual properties and ensure the systems do not have adverse impacts on health and the environment. Local councils are responsible for ensuring that the approved system is installed according to specifications and any special conditions, and is maintained and serviced correctly. You should consult your local council on the regulations that apply to you.

Care of the septic tank is only a part of the maintenance of your septic system. Management of the treated wastewater from your septic system is your responsibility and is discussed in the pamphlet "Your Land Application Area". Heavy fines may be imposed if the effluent is managed improperly.

Maintaining your septic system

The effectiveness of the system will, in part, depend on how it is operated and maintained. The following is a guide on how to achieve the most from your system.

DO

- ✓ Have your septic tank desludged every three years to prevent sludge build up, which may 'clog' the pipes and absorption trenches.
- ✓ Have your septic tank serviced annually by contractors to check scum and sludge levels, and the presence of blockages in the outlet and inlet pipes.
- ✓ Have your grease trap (if installed) cleaned out at least every two months.
- ✓ Keep a record of pumping, inspections, and other maintenance.
- ✓ Learn the location and layout of your septic system and land application area.
- ✓ Check household products for suitability for use with a septic tank.
- ✓ Use biodegradable liquid detergents, such as concentrates with low phosphorous.
- ✓ Ensure your tank is mosquito-proofed.
- ✓ Conserve water.

Maintaining your land application area

The effectiveness of the application area is governed by the activities of the owner.

DO

- ✓ Construct and maintain diversion drains around the top side of the application area to divert surface water.
- ✓ Ensure that your application area is kept level by filling any depressions with good quality top soil (not clay).
- ✓ Keep the grass regularly mowed and plant small trees around the perimeter to aid absorption and transpiration of the effluent.
- ✓ Ensure that any run off from the roof, driveway and other impermeable surfaces is directed away from the application area.
- ✓ Fence irrigation areas.
- ✓ Ensure appropriate warning signs are visible at all times in the vicinity of a spray irrigation area.
- ✓ Have your irrigation system checked by the service agent when they are carrying out service on the treatment system.

DON'T

- ✗ Don't erect any structures, construct paths, graze animals or drive over the land application area.
- ✗ Don't plant large trees that shade the land application area, as the area needs sunlight to aid in the evaporation and transpiration of the effluent.
- ✗ Don't plant trees or shrubs near or on house drains.
- ✗ Don't alter stormwater lines to discharge into or near the land application area.
- ✗ Don't flood the land application area through the use of hoses or sprinklers.
- ✗ Don't let children or pets play on land application areas.
- ✗ Don't water fruit and vegetables with the effluent.
- ✗ Don't extract untreated groundwater for potable use.

Warning signs

Regular visual checking of the system will ensure that problems are located and fixed early.

The visual signs of system failure include:

- ⚠ surface ponding and run-off of treated wastewater
- ⚠ soil quality deterioration
- ⚠ poor vegetation growth
- ⚠ unusual odours

Volume of water

Land application areas and systems for on-site application are designed and constructed in anticipation of the volume of waste to be discharged. Uncontrolled use of water may lead to poorly treated effluent being released from the system.

If the land application area is waterlogged and soggy the following are possible reasons:

- ⚠ Overloading the treatment system with wastewater.
- ⚠ The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- ⚠ The application area has been poorly designed.
- ⚠ Stormwater is running onto the area.

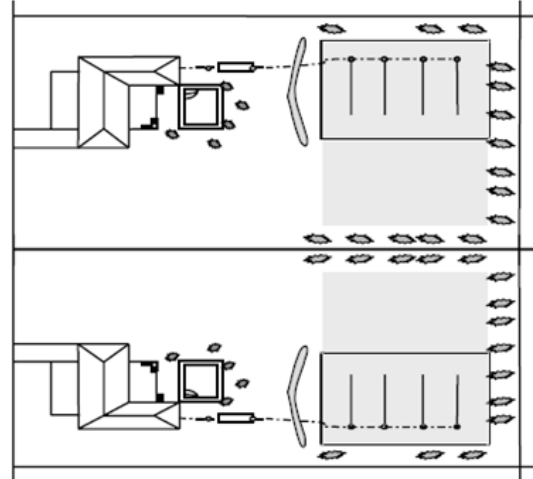
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

For more information please contact:

Your Land Application Area



LAND APPLICATION AREAS

The reuse of domestic wastewater on-site can be an economical and environmentally sound use of resources.

What are land application areas?

These are areas that allow treated domestic wastewater to be managed entirely on-site.

The area must be able to utilise the wastewater and treat any organic matter and wastes it may contain. The wastewater is rich in nutrients, and can provide excellent nourishment for flower gardens, lawns, certain shrubs and trees. The vegetation should be suitably tolerant of high water and nutrient loads.

How does a land application area work?

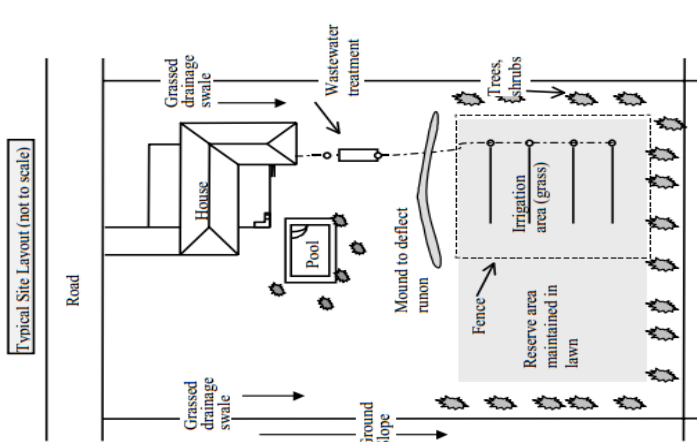
Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

Soil absorption systems do not require highly treated effluent, and wastewater treated by a septic tank is reasonable as the solids content in the effluent has been reduced. Absorption systems release the effluent into the soil at a depth that cannot be reached by the roots of most small shrubs and grasses. They rely mainly on the processes of soil treatment and then transmission to the water table, with minimal evaporation and up-take by plants. **These systems are not recommended in sensitive areas as they may lead to contamination of surface water and groundwater.**

Irrigation systems may be classed as either subsurface or surface irrigation. If an irrigation system is to be used, wastewater needs to be pre-treated to at least the quality produced by an aerated wastewater treatment system (AWTS).

Subsurface irrigation requires highly treated effluent that is introduced into the soil close to the surface. The effluent is utilised mainly by plants and evaporation.

Surface irrigation requires highly treated effluent that has undergone aeration and disinfection treatments, so as to reduce the possibility of bacteria and virus contamination.



The effluent is then applied to the land area through a series of drip, trickle, or spray points which are designed to eliminate airborne drift and run-off into neighbouring properties.

There are some public health and environmental concerns about surface irrigation. There is the risk of contact with treated effluent and the potential for surface run-off. Given these problems, subsurface irrigation is arguably the safest, most efficient and effective method of effluent utilisation.

Regulations and recommendations

The design and installation of land application areas should only be carried out by suitably qualified or experienced people, and only after a site and soil evaluation is done by a soil scientist. Care should be

taken to ensure correct buffer distances are left between the application area and bores, waterways, buildings, and neighbouring properties.

Heavy fines may be imposed under the Clean Waters Act if effluent is managed improperly.

At least two warning signs should be installed along the boundary of a land application area. The signs should comprise of 20mm high Series C lettering in black or white on a green background with the words:

**RECLAIMED EFFLUENT
NOT FOR DRINKING
AVOID CONTACT**

Depending on the requirements of your local council, wet weather storage and soil moisture sensors may need to be installed to ensure that effluent is only irrigated when the soil is not saturated.

Regular checks should be undertaken of any mechanical equipment to ensure that it is operating correctly. Local councils may require periodic analysis of soil or groundwater characteristics

Humans and animals should be excluded from land application areas during and immediately after the application of treated wastewater. The longer the period of exclusion from an area, the lower the risk to public health.

The householder is required to enter into a service contract with the installation company, its agent or the manufacturer of their sewage management system, this will ensure that the system operates efficiently.

Location of the application area

Treated wastewater has the potential to have negative impacts on public health and the environment. For this reason the application area must be located in accordance with the results of a site evaluation, and approved landscaping must be completed prior to occupation of the building. Sandy soil and clayey soils may present special problems.

The system must allow even distribution of treated wastewater over the land application area.