Land Capability Assessment Report

Location: 100 Grip Road, TOORA

Lot 1, PS117576

Date: 14 November 2014

Prepared for: Gary Wallis,
2180 Promontory Road, Fish Creek 3959

Report standard: *MAV Land Capability Assessment Framework*, January 2014

Prepared by:

EWS ENVIRONMENTAL

EWS Environmental
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Reference: 141016

Environment Protection Act 1970

Part IXB – Septic Tank Systems, Section 53MA

AS/NZS 1547: 2012 – Section 7. 4. 2 - CERTIFICATE OF LOADING - DESIGN Job No. 141016

To

Environmental Health Officer – South Gippsland Shire Council

Building Surveyor - Relevant Building Surveyor

From

EWS Environmental Email: ews@bigpond.com
Phone (03) 9849 0150, Postal address: PO Box 4, Box Hill VIC 3128

Property details

Address: **Lot 1, PS117576, 100 Grip Road, TOORA**

Compliance

I have undertaken a land capability assessment (LCA) and prepared the design and certify that the part of the design described as: **Septic tank system**

complies with the following provisions:

- EPA Code of Practice – Onsite Wastewater Management, No. 891.3, February 2013;
- AS/NZS 1547:2012 - On-site domestic wastewater management, Standards Australia;

Capacity of system

Volume of wastewater generated by development not to exceed **720** litres/day.

Design criteria dispersal

Minimum land irrigation area to be reserved for management of effluent is **220** square metres.

Wastewater treatment

An EPA approved treatment system must be operated and maintained onsite prior to effluent dispersal at all times.

Water efficiency

The design is based on the *precautionary principle* where fittings and fixtures have a **3 star WELS** rating or better.

Consequences of overloading, lack of operation, maintenance and monitoring

Over or under loading for extended periods (more than a month) will have an adverse impact on the performance of the treatment system. Occupiers of premises must:

- Report unusually high water usage, and/or discharges of inappropriate chemicals;
- Monitor for odours, ponding of effluent or audio/visual alarm activation;
- Keep a record of pump-outs, servicing periods and display emergency numbers, and
- Cause primary septic tank chamber to be pumped out at least once **every 3 years.**

John Lawrey JohnLawrey	*Professional Engineer*	Reg. No. 142295
Senior Environmental Engineer	*Dip CE MIEAust*	Date: 14 November 2014

Accreditation: On-site Wastewater Management Certificate CET-NZ, 2001
Professional Indemnity: Resource Underwriting Pacific Pty Ltd. Policy No. 24798, Period: 01/07/14 to 01/07/15.

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Certificate of Loading

1. Introduction

EWS Environmental has been engaged to undertake a Land Capability Assessment (LCA) for a site of about 1590 m2 at Lot 1, PS117576 Grip Road, TOORA.

Consultant

EWS Environmental has been engaged to develop a wastewater plan to support a Land Capability Assessment (LCA) for an application for a Council permit.

To further assess land features for long-term sustainable development and address the risk consequences of using best practice (septic sewerage) management options.

The field investigation and report have been undertaken and prepared by suitably experienced consultant. EWS Environmental has appropriate professional indemnity insurance for this type of work, details of which are enclosed.

Report Summary

This report will accompany an application for a Septic Tank Permit to Install submitted to South Gippsland Shire Council for an onsite wastewater management system for a private residence.

This document provides information about the site and soil conditions. It also provides a detailed LCA for the site, and includes a conceptual design for a suitable onsite wastewater management system, including recommendations for monitoring and management requirements. A number of options are provided for both the treatment system and land application area (LAA). However, the wastewater should be treated to secondary level by a suitable EPA-approved treatment system and the effluent applied to land via sub-surface irrigation.

Site overview

Location

Lot 1, PS117576 Grip Road, TOORA Map Ref: VicRoads 708 B-11 Nearest cross Road: Jetty Rd
Land area: 1590 m^2 Number of bedrooms: 3

Land features

Waterway: Muddy Creek. Slope of land: 2% Distance to surface water 30m:
Flooding: > 1 in 20 years Climate: Rainfall 941 mm Evap 'A' 1054 mm
Soil type: Silty light CLAY Permeability (K_{sat}) 0.06-0.12 metre/day.

Wastewater system sizing (AS/NZS 1547:2012)

Maximum flow: 4 persons x 150 (Litres/day) = 720 litres, Water supply: assumed reticulated.
Design Loading rate(DLR) 5 litres/m^2.day Dispersal area: 205 (m^2)
EPA approved secondary treatment and 54 m WICK trenches by 1.6m to Code requirements.
Preferred option Mound system 205m2.

Management

Annual servicing: YES Desludging primary tank: every 3 years
Quarterly servicing of treatment plant and inspection of effluent dispersal areas.

2. Description of the Development

Site Address:	Lot 1, PS117576 Grip Road, TOORA
Owner/Developer:	Gary Wallis,
Postal Address:	2180 Promontory Road, Fish Creek 3959
Contact:	Ph: 0429 427 656
Council Area:	South Gippsland Shire Council
Allotment Size:	1590 m²
Domestic Water Supply:	Onsite roof water collection, reticulated supply assumed
Anticipated Wastewater Load:	A 3-bedroom residence with full water-reduction fixtures @ 4 people per maximum occupancy. Wastewater generation = 180 L/person/day; total design load = 720 L/day (source Table 4, EPA Code (891.3:2013).
Availability of Sewer:	The area is unsewered and highly unlikely to be sewered within the next 10 years, due to low development density in the area and the considerable distance from existing sewerage services.

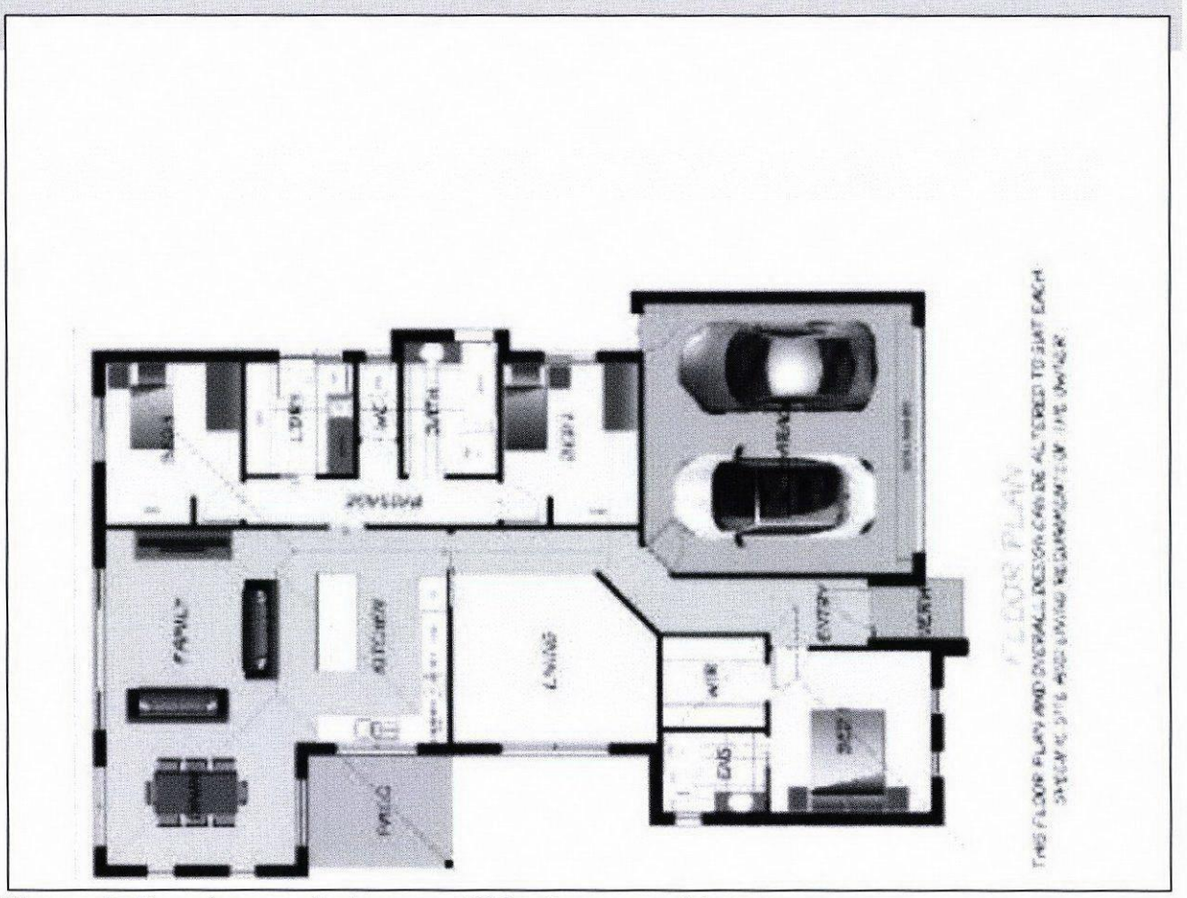


Figure 1: Development plan - #3 bedroom residence

3. Site and Soil Assessment

EWS Environmental undertook site investigations on the 24 October 2014.

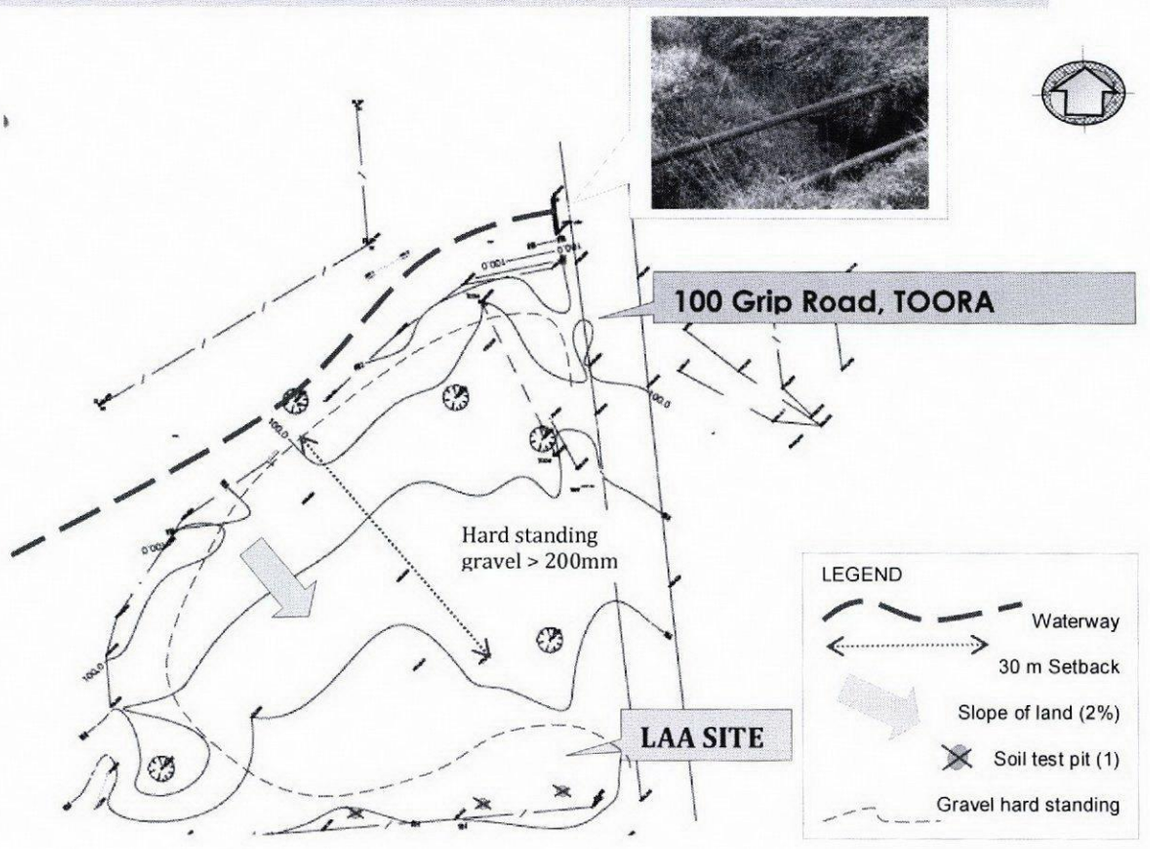
SITE KEY FEATURES

Table 1 summarises the key features of the site in relation to effluent management for proposed site.

NOTE:

- The site is not in a special water supply catchment area.
- The site experiences negligible stormwater run-on.
- There is no evidence of a shallow watertable or other significant constraints, and
- The risk of effluent transport offsite is very low.

Figure 1 below provides a locality plan and indicates the location of the site of the proposed development. Figure 2 provides a site plan describing the location of the proposed building envelope and other development works, wastewater management system components and physical site features.

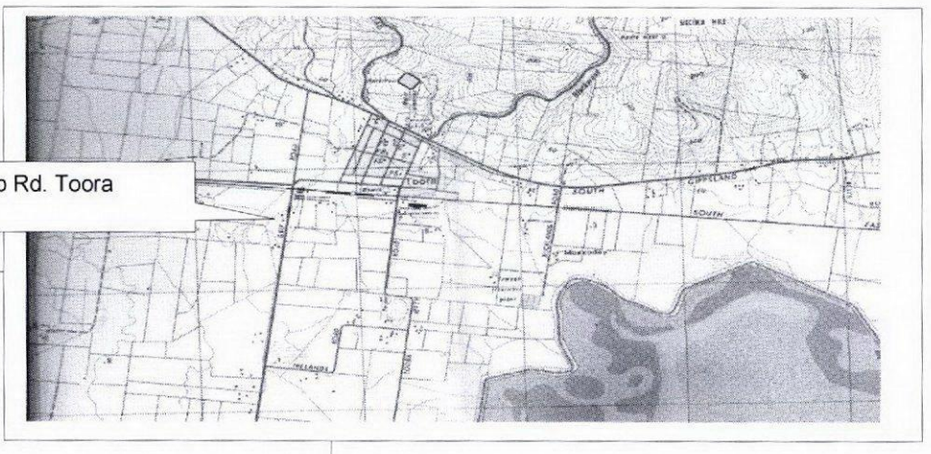


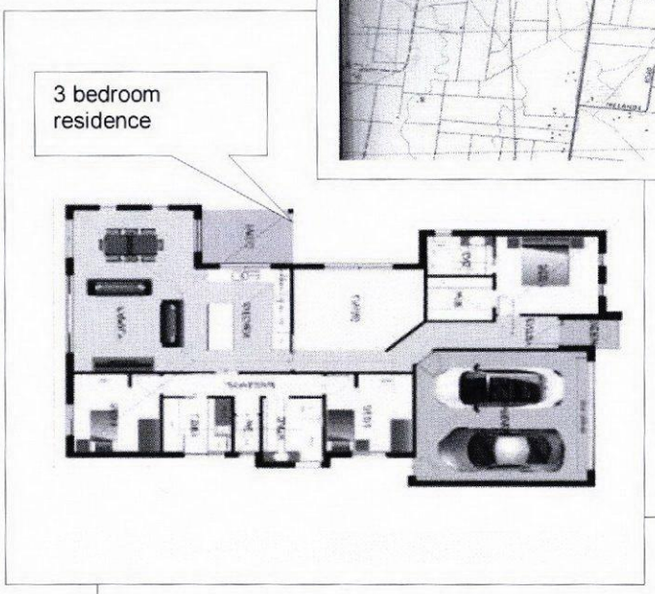
Location: **Lot 1, PS117576 Grip Road, TOORA** Map Ref: VICROADS **708 B-11** Groundwater Cat: **Pot**able

Figure 2: Site analysis

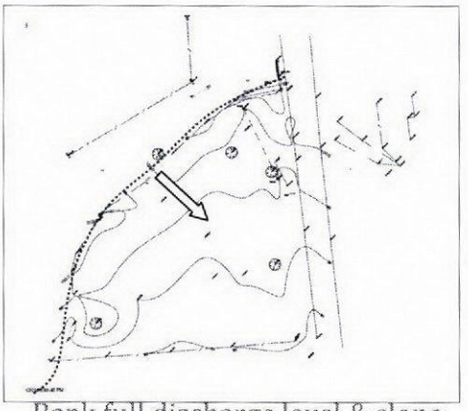
SITE DETAILS

Topographic map



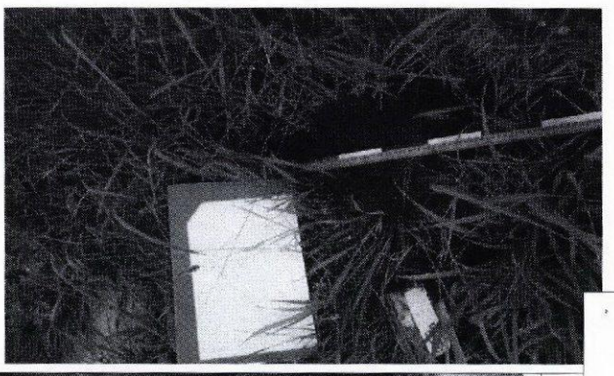


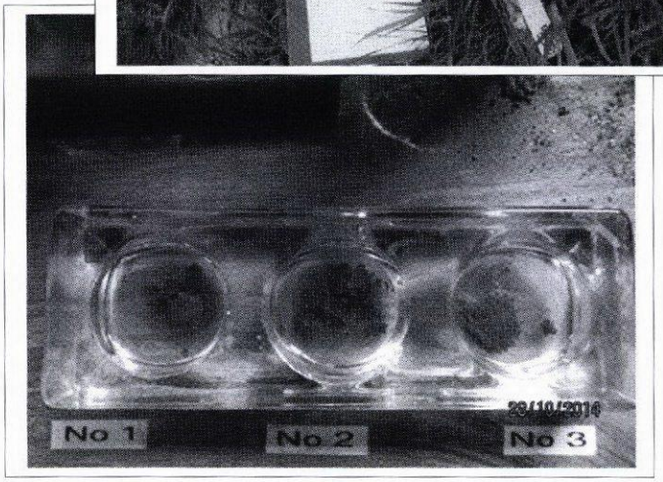
Floor plan



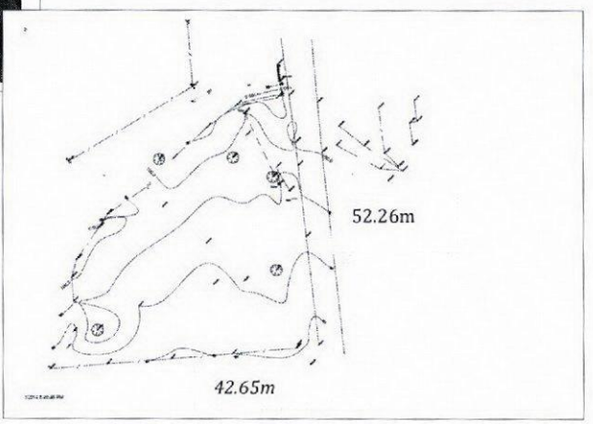
Bank full discharge level & slope

Hole #1





Modified Emerson test – no dispersion



Property dimensions

Location: Lot 1, PS117576 Grip Road, TOORA Date: 28 October 2014 Taken by: JR Lawrey

Table 1: Site Assessment

Feature	Description	Constraint	Measures
Buffer Distances	All relevant buffer distances in Table 5 of the Code (2013) are achievable.	Minor	NN*
Climate	Mean annual rainfall 941 mm. Mean annual pan 'A' evaporation is 1054 mm.	Minor	NN
Drainage	No visible signs of surface dampness, spring activity or hydrophilic vegetation in the proposed effluent management area.	Moderate	Adopt low DIR
Erosion & Landslip	No evidence of sheet or rill erosion; the erosion hazard is low. No evidence of landslip and landslip potential is low.	Minor	NN
Exposure & Aspect	Woodland with understory vegetation, with a southerly aspect and has high wind exposure.	Minor	NN
Flooding	The proposed effluent management area is located above the 1:100 year flood level.	Minor	NN
Groundwater	No signs of shallow groundwater tables to 1.5 m depth. No potential groundwater bores within 50 m of the proposed effluent area. Total dissolved solids less than 1000 mgTDS/L.	Minor	NN
Imported Fill	No imported fill material observed on the site.	Nil	NN
Land Available for LAA	Considering all the constraints, the site has ample suitable land for application of effluent.	Nil	NN
Landform	Natural drainage with no spreading over linear plannar slope. No significant drainage lines intersect dispersal area.	Moderate	Locate with appropriate setbacks
Rock Outcrops	No evidence of surface rocks or outcrops.	Nil	NN
Run-on & Runoff	Minor stormwater run-on and run-off hazard.	Nil	NN
Slope	The proposed effluent management area has a slope of less than 2 percent, to the south.	Nil	NN
Surface Waters	No waterways traverse the site requiring minimum setback to treatment /effluent area.	Nil	NN
Vegetation	Mixture of grasses and native vegetation.	Nil	NN

*NN: mitigation measures not needed

SOIL KEY FEATURES

The site's soils have been assessed for their suitability for onsite wastewater management by a combination of soil survey and field analysis as outlined below.

Site assessment criteria

This assessment undertaken in accordance with the EPA's *Code of Practice - Onsite Wastewater Management, February 2013* and AS/NZS 1547:2012, *Onsite Domestic Wastewater Management*.

Soil assessment and design for on-site wastewater management was taken from AS/NZS 1547:2012, *On-site domestic wastewater management*, where appropriate.

Site investigations

A key feature of the assessment is a soil permeability assessment in each landscape element or soil type area for effluent attenuation within the boundaries of the premises. Review geological and soil mapping data (DEPI).

EPA's Code of Practice Publication 891.3 (2013) indicates that visual and tactile estimation of indicative permeability based on the latest version of AS/NZS 1547 'Site and Soil Evaluation' procedures, which includes soil texture, structure and swell potential tests, may be used as a substitute for actual measurement of soil permeability.

Soil permeability has been determined from the critical properties of texture, structure and shrink/swell potential using the method specified in AS/NZS 1547:2012 that prescribes conservative design loading rates.

The structure and texture of the soil was such that a constant head test would not influence the final classification of moderately structured Light CLAY for our design loading rate.

Indicative soil permeability

Classification	Properties	ategory	K_{sat} (m/d)	Wick	Mound	LPED
Gravel & sands	Very little to no coherence; cannot be moulded; single grains stick to fingers	1	> 3.0	25	24	NA
Sandy LOAM	Forms a cast but will not roll into coherent ball; sand gr can be seen and felt; gives a ribbon 15-25 mm long.			30	24	4
LOAMS	Forms a cast but not spongy, very smooth and silky; wil form a very thin ribbon 25 mm long and dries rapidly.			30	16	3.5
Clay LOAM	Can be rolled into ball with a spongy feel; slightly plastic; smooth to manipulate; forms a ribbon 40-50 mm long.	4	0.12 –	20	8	3
Light CLAY	Smooth plastic ball that can be rolled, slight resistance to shearing between thumb and fore finger; ribbon 50 –70mm.	5	< 0.06–0.12	**10**	**5-8**	2.5
Medium to heavy CLAY	Smooth plastic ball, handles like plasticine, can be moulded into rods without fracture; some resistance to ribboning, forms a ribbon 75mm or more long.	6	< 0.06	5	5	NA

Design Loading Rate for Silty light CLAY
DLR 10 L/m2.day

Reference: EPA Publication 891.3:2014

See attachment 'A' for all soil test results and field records.

Site Assessment Results

Based on the most constraining site features (landform and drainage), the overall land capability of the site to sustainably manage all effluent onsite is satisfactory. The proposed effluent management area is located above the 1:100 flood level and by using secondary treatment and above ground mound system, there will be ample protection of surface waters and groundwater.

Table 2: Soil Assessment

Feature	Assessment	Constraint	Mitigation
Cation Exchange Capacity (CEC)	Present soil conditions do not appear to be restricting plant growth.	Minor	NN
Electrical Conductivity	EC (1:5 soil:water suspension) 42 microSiemens (µS) per centimetre (topsoil), which is equal to low saline.	Minor	NN
Emerson Aggregate Test (Modified test AS/NZS 1546)	Topsoil: Class 2 (slaking without dispersion).	Minor	NN
pH	Topsoil pH about 6.0 which is slightly acidic; subsoils range slightly higher which is neutral. Soil conditions do not appear to be affecting plant growth.	Minor	NN
Phosphorus adsorption capacity	Phosphorus adsorption capacity was not specifically tested but is expected to be moderate to high due to the extent of clay present at relatively shallow depths.	Minor	NN
Rock Fragments	Coarse fragments more than 20% (200 mm depth). No fragments throughout the remainder of the profile.	Minor	NN
Sodicity (ESP)	Exchangeable Sodium concentrations are minor with no long-term soil sodicity monitoring recommended. Present soil conditions do not appear to be restricting plant growth.	Minor	NN
SAR	Sodium absorption ratio is not a constraint.	Minor	NN
Soil Depth	Topsoil: <200 mm	Minor	NN
	Subsoil: >200 mm. Total soil depth greater than 1.5 m and no hardpans occur.	Minor	NN
Soil Permeability & Design Loading Rates	Topsoil: Massive Silty light CLAY, 0.06 -0.12 m/day saturated conductivity (K_{sat}) (AS/NZS1547:2012); 5 mm/day Design Loading Rate (DLR) for Mound system (Code, 2013).	Minor	NN
	Subsoil: Silty light CLAY :0.06-0.12 m/day saturated conductivity (K_{sat}) (AS/NZS1547:2012);	Moderate	
Soil Texture & Structure	Topsoil (<200 mm): Silty light CLAY Category 5b moderate structure. Gravel to 200mm in hard standing area.	Minor	Mound system or
	Subsoil (>200 mm): Silty light CLAY Category 5b moderate structure) in accordance with AS/NZS/NZS 1547:2012	Major	WICK irrigation recommended
Watertable Depth	Groundwater not encountered,	Minor	

NN: mitigation measures not needed

RISK MANAGEMENT ASSESSMENT

Table 3: Risk Assessment of Site Characteristics

Characteristic	Level of Constraint			Assessed Level of Constraint for Site
	Nil or Minor	Moderate	Major	
Aspect (affects solar radiation received)	North / North-East / North-West	East / West / South-East / South-West	South	Minor
Climate (difference between annual rainfall and pan evaporation)	Excess of evaporation over rainfall in the wettest months	Rainfall approximates to evaporation	Excess of rainfall over evaporation in the wettest months	Minor
Erosion (or potential for erosion)	Nil or minor	Moderate	Severe	Minor
Exposure to sun and wind	Full sun and/or high wind or minimal shading	Dappled light	Limited patches of light and little wind to heavily shaded all day	Minor
Imported Fill	No fill or minimal fill, or fill is good quality topsoil	Moderate coverage and fill is good quality	Extensive poor quality fill and variable quality fill	Minor
Flood frequency (ARI)	Less than 1 in 100 years	Between 100 and 20 years	More than 1 in 20 years	Minor
Groundwater bores	No bores onsite or on neighbouring properties	Setback distance from bore complies with requirements in EPA Code of Practice 891.3 (as amended)	Setback distance from bore does not comply with requirements in EPA Code of Practice 891.3 (as amended)	Minor
Land area available for LAA	Exceeds LAA and duplicate LAA and buffer distance requirements	Meets LAA and duplicate LAA and buffer distance requirements	Insufficient area for LAA	Minor
Landslip (or landslip potential) [5]	Nil	Minor to moderate	High or Severe	Minor
Rock outcrops (% of surface)	<10%	10-20%	>20%	Minor
Slope Form (affects water shedding ability)	Convex or divergent side-slopes	Straight side-slopes	Concave or convergent side-slopes	Minor
Slope gradient (%)				
(a) for absorption trenches and beds	<6%	6-15%	>15%	Minor
(b) for surface irrigation	<6%	6-10%	>10%	Minor
(c) for subsurface irrigation	<10%	10-30%	>30%	Minor
Soil Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface & soil pit	Minor

Characteristic	Level of Constraint					Assessed Level of Constraint for Site
	Nil or Minor		Moderate	Major		
Soil Drainage (Field Handbook definitions)	Rapidly drained.	Well drained.	Moderately well drained.	Imperfectly drained.	Poorly/Very poorly drained.	Moderate

Characteristic	Level of Constraint			Assessed Level of Constraint for Site
	Nil or Minor	Moderate	Major	
Stormwater run-on	Low likelihood of stormwater run-on		High likelihood of inundation by stormwater run-on	Minor
Surface waters - setback distance (m)	Setback distance complies with EPA Code of Practice 891.3		Setback distance does not comply with EPA Code (as amended)	Minor
Vegetation coverage over the site	Plentiful vegetation with healthy growth, good nutrient uptake	Limited variety of vegetation	Sparse vegetation or no vegetation	Minor

Table 4: Risk Assessment of Soil Characteristics

Characteristic	Level of Constraint			Assessed Level of Constraint for Site
	Nil or Minor	Moderate	Major	
Electrical Conductivity	<0.8	0.8 - 2	>2	Minor
Emerson Aggregate Class	4, 5, 6, 8	7	1, 2, 3	Minor
Gleying (Munsell Soil Colour Chart)	Nil	Evidence of greenish grey / black or bluish grey / black soil	Predominant greenish grey / black, bluish grey / black colours	Minor
Mottling (Munsell Soil Colour Chart)	Generally uniform brownish or reddish colour	Imperfectly drained soils have grey and/or yellow brown mottles	Poorly drained soils predominant yellow brown or reddish mottles	Minor
pH (range for plants)	5.5 - 8 is optimum range for plants	4.5 - 5.5 suitable for acid-loving plants	<4.5, >8	Minor
Rock Fragments (size & volume %)	0 – 10%	10 – 20 %	>20%	Minor
Sodicity [4] (ESP %)	<6%	6 – 8%	>8%	Minor
Soil Depth to Rock or impermeable layer	>1.5 m	1.5 – 1 m	<1 m	Minor
Soil Structure (pedality)	Highly or Moderately structured	Weakly-structured	Structureless, Massive or hardpan	Minor
Soil Texture, (indicative permeability)	Cat. 2b, 3a, 3b, 4a	Cat. 4b, 4c, 5a	Cat. 1, 2a, 5b, 5c, 6	Moderate
Watertable Depth (m) below base of the LAA	>2 m	2 – 1.5 m	<1.5 m	Moderate

Legend:

Nil or Minor: If all constraints are minor, conventional/standard designs are generally satisfactory.

Moderate: For each moderate constraint an appropriate design modification over and above that of a standard design, should be outlined.

Major: Any major constraint might prove an impediment to successful on-site wastewater management, or alternatively will require in-depth investigation and incorporation of sophisticated mitigation measures in the design to permit compliant onsite wastewater management.

Table 5 - Control measures for risk levels.

Level	Descriptor	Measures of control impact
1	Negligible	Resolve with phone call
2	Minor	Pick- up during routine servicing, low financial cost
3	Medium	Maintenance frequency increased, small financial cost
4	Significant	Significant works required, moderate financial cost
5	Severe	Replace components/system - moderate financial cost

4. Wastewater Management System

The following sections provide an overview of a suitable onsite wastewater management system, with sizing and design considerations and justification for its selection. Detailed design for the system should be undertaken at the time of the application submitted to Council.

TREATMENT SYSTEM

The secondary effluent quality required is:

- Biochemical Oxygen Demand, less than 20 mg/L;
- Total Suspended Solids, less than 30 mg/L;

Refer to the EPA website for the list of approved options that are available http://www.epa.vic.gov.au/en/your-environment/water/onsite-wastewater. Any of the secondary treatment system options are capable of achieving the desired level of performance. The property owner has the responsibility for the final selection of the secondary treatment system and will include the details of it in the *Application to Install a Septic Tank System* form for Council approval.

The pros & cons depend on site and waste characteristics listed below:

Table - PROS and CONS of options for treatment of wastewater.

DISPERSAL METHOD	PROS	CONS
Option A – Primary settling to reduce grease and solids  30% pollutant removal	☑ Minimal maintenance ; ☑ Less expensive operating costs although technically problematic. ☑ Robust operation.	☒ Design service life of 15 years; ☒ Must be connected to sewer immediately it become available; ☒ Not suitable for type 1 or 6 soils; ☒ Sensitive to terrain slope & setbacks to waterway; ☒ Generally requires more space; ☒ Requires a lot > 2000 m^2.
Option B – Secondary system such as aerated systems  90% pollutant removal ✓	☑ Design service life of 30 years; ☑ Default "*best practice*" system ☑ Suitable for type 1 & 6 soils; ☑ Copes with higher organic and nutrient loads; ☑ Minimal maintenance ☑ Suitable for lots < 2000m^2; ☑ Minimises polluted run-off risk	☒ Higher maintenance costs; ☒ Higher energy costs; ☒ Slightly higher installation cost;

EFFLUENT MANAGEMENT SYSTEM

A range of possible land application systems have been considered, such as absorption trenches, evapo-transpiration / absorption (ETA) beds, subsurface irrigation and mounds.
The options for dispersal of treated effluent are limited to those either specifically approved by EPA or systems installed in accordance with Australian Standard AS/NZS 1547:2012.

Sizing the Irrigation System

To determine the necessary size of the land application area water balance modelling has been undertaken using the method in the Victorian Land Capability Assessment Framework (2014) and the EPA Code (2013).

The preferred system is pressure compensating subsurface irrigation, however, gravel top layer will provide not allow even and widespread dispersal of the treated effluent within the root-zone of plants. It will also enhance risk of effluent being transported off-site.

PREFERRED OPTION -- SUB-SURFACE DISPERSAL VIA MOUND SYSTEM

For ***type 5b*** soil, area required for 180 x 4 = 720 litres per day from EPA 891.3 Table 9,

Mound sizing -

Number of bedrooms: ***3,*** *No. of persons: 4. Soil type: Light CLAY (5b) Soil permeability* ***0.06-0.12*** *m/day Slope of land:<* ***2%,*** *Slope risk factor 1.0.*

Absorption bed area is daily flow/ bed loading rate ie 720 / 40 = $\mathbf{A_a}$ = 18 m^2.
Linear loading rate of 40 L/m length 720 L/d / 40L/m/day = 720/40 = 18m
Width **= 2.0m, Length 9m**

Basal area of mound is daily flow divided by DLR loading rate of 5mm/day,
area required is $\mathbf{A_b}$ = 720 /5 = 144m^2 ,

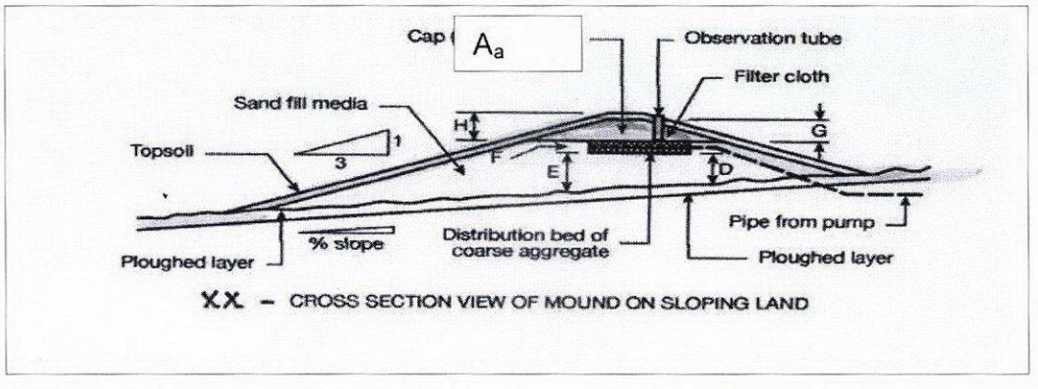
Water balance calculations
However, from the water balance calculations, over page the minimum area required is 205 m^2 for primary effluent and an equal as a reserve, or treated effluent area say 205m^2.

Height of mound is **D + F + H** where,

D, depth of sand (600) for primary effluent + **F**, depth of absorption bed (225) + **H**, 450mm

Overall depth of mound at highest point is 600 + 225 + 450 = 1275mm or 1.275metre.
Maximum batter length from slope is 1(v) to 3 (h) therefore 3 x 1.275 = 3.825m + 2%= 4m,
Basal area is length (m) times width of lateral distribution plus slope face

Width of mound is twice batter length plus width of absorption bed **A**= 2 + (2 x 4m) =10.0**m**.
Length of mound is twice batter length plus length of absorption bed **B**= 2 x 4m + 9m= 17**m.**
Say 11 x 20 = 220m2
Minimum area of mound, based on hydraulic and nutrient loading rate is 220 + buffer 1.5 by 20 = 250 **m^2**



Design specification and size of mound for 3 bedroom residence

Mound design - Reference Appendix N – AS/NZS 1547:2012

Size a "Wisconsin Mound" system for a typical seven (7) bedroom residence on category **5b** type soil with assumed reticulated water supply.

Mound application -

Mounds are generally used on relatively flat sites that have site or soil constraints. These constraints may be:

- Slowly permeable soils;
- Permeable layer (300 to 600mm of soil over limiting layer), or
- Permeable soils with high ground water table within 600mm of ground level.

Primary effluent is dosed onto the sand filled mound to ensure further treatment (secondary) takes place prior to infiltrating into the underlying soil, which is ploughed beforehand.

Mound design criteria –

Distribution bed, loading rate	40 L/m^2.day
Bed aggregate fill	20 - 60mm, minimum depth 150mm
Minimum thickness of bed	0.225m
Maximum length of bed	20 m
Maximum width of bed	3 m
Mound batter slope (v: h)	1 to 3
Linear loading rate	50 L/m.day, maximum 25L/m.day desirable
Basal area loading of mound	5 mm/day
Sand fill depth	0.3 to 0.6m (secondary & primary effluent)
Sand fill media	effective size 0.25 to 1.0 mm
Uniformity co-efficient	less than 4
Fines(clay & fine silt 200 sieve)	less than 3%

Description of the "Wick" trenches system

"Wick" trenches are a new method for dispersal of effluent suitable for small sites with limited space and low soil permeability. This type of system combines absorption and evapo-transpiration to best use available space. Installation is undertaken in accordance with Appendix E, EPA Code(2013).

The key design advantage of this system is the use of a geotextile fabric that acts as a wick to distribute effluent over the bed pan of the trench providing a much larger surface area for evapo-transpiration compared to standard trenches with a reserve capacity in the design.

The water balance can be expressed by the following equation:

Precipitation + Effluent Applied = Evapo-transpiration + Percolation

Data used in the water balance includes:

- Mean monthly rainfall and mean monthly pan evaporation;
- Average daily effluent load – 720 L (from Table 4 of the Code);
- Design irrigation rate (DLR) – 5 mm/day (from Table 3 of the Code);
- Crop factor – 0.6 to 0.8; and
- Retained rainfall – 75% (slope of mound 33%).

The nominated area method is used to calculate the area required to balance all inputs and outputs to the water balance. As a result of these calculations at least 205 m^2 of land application area is required.

Hydraulic loading

Assume wastewater flow from EPA Code based on potential occupancy calculated using the criteria of : *;(Number of Bedrooms) +1 ;* persons x 150 for our design flow.
Number of bedrooms: ***3****, Soil type: Silty light CLAY (****4****)* Slope factor: 2%

OPTION 2 -- SUB-SURFACE DRIP IRRIGATION

For ***type 3*** soil area required for 720 litres per day from AS/NZS 1547, Table 9 EPA Code adopting 3.0mm/day= 720/ 3.0 = 240 m^2 NOT PROPOSED.

Sub-surface lines @ 1 m centres

OPTION 3 -- WICK TRENCHES

EPA Code, Appendix E, calculations length of WICK Trench System for 3 bedroom house on Silty light CLAY soil

Length of Trench/Bed = Q/[DLR x (W/F)]

= [(3 bedrooms +1) x180 L/day] / [DLR L/m^2 x 1.6/1.2]
= 720L/10 L/m^2 x 1.6m/ 1.2]
= 720 L/ 13.33 L/m
= 54 m

From water balance trench area required is 87m2 divided by 1.6m = 54.3m of trenching

Area of WICK Trench System

= 54 x (600mm + 1000mm)
=54 m x 1.6m = 87m^2 + spacing between trenches 1m x 27m
= 3 trenches x 18m + 1m apart = 18 x 7= 126m2 + buffer 110 say 240 m^2

Nutrient balance

For sustainable, long-term nutrient management, when **nitrogen** is the limiting factor:

- *Use uptake for grasses @ 200 kg TN /ha.year, EPA Guidelines for Wastewater Irrigation, Pub. No.168.*
- *Crop factor for tall fescue grass 220 kg/ha.yr = 220 x 1000 x 1000/10,000/365 = 60mg TN/m^2.day.*
- *In clayey soil, phosphorus is not a limiting factor, due to adsorption onto clay particles.*
- *Allow 20% loss through denitrification, volatilisation, microbial attack and other processes,*

= 720 x 25 x 08 divided by 60 mgTN/m2.day = 240m2.

See Water and Nutrient balance spreadsheet calculations for most limiting minimum land application area (LAA).

Salt balance

For sustainable,– long-term soil management salt (sodium) levels in water supply and the addition of contributed by washing and use of laundry detergents may cause soils to become less permeable.

Measures to minimise salinity effects include reduced detergent use, low irrigation rates, growing salt tolerant grasses in dispersal area and restricting salt levels in effluent to less than 500 mgTDS/litre.
Use salt tolerant grasses like Kikuyu or Couch grass, ***EPA Guidelines for Wastewater Irrigation, No.168.***

Leaching of salt is quantified by a water balance to ensure adequate remove of salt for the dispersal field. Typical sewage salt input is about 375 mgTDS/L, with no addition for tank water supply levels are below 500.

The options considered and available for use currently are:

A. Evapo-transpiration(ETA) trenches;
B. Mound system raised above ground level;
C. Low pressure effluent distribution systems (LPED);
D. Conventional soil absorption trenches, and
E. Wick trench or bed systems.

The pros & cons depending on terrain, rainfall and soil conditions are listed below:

Table 7 - PROS and CONS of options for treatment of wastewater and effluent dispersal.

DISPERSAL METHOD	PROS	CONS
Option A – Pressure compensating drip irrigation	☑ Suitable for shallow soil sites ☑ Not restricted due to rainfall ☑ Less soil depth required to others ☑	☒ Higher maintenance and capital replacement costs ☒ More expensive system ops with technical matters problematic ☒ Maximum slope of 30% ☒ Generally requires more space.
Option B – Mounds ✓	☑ Raise level of effluent discharge ☑ Soil depth less important ☑ Minimal maintenance ☑ Suitable ground saturated sites ☑ Minimises polluted run-off risk	☒ Sensitive to terrain slope & setback to waterways ☒ Max. 15% slope situations ☒ May increase wetness at edge ☒ Toe seepage may occur.
Option C – LPED systems	☑ Lower energy requirement ☑ Complementary loading of system for balance flow ☑ Minimal maintenance ☑ Trench spacing up to 2m apart	☒ Sensitive to terrain slope & setback to waterways ☒ Minimum 250mm topsoil ☒ Not suitable type 1 & 6 soils
Option D – Wick trenches	☑ Lower energy requirement ☑ Compact system ☑ Complementary trench loading ☑ Balancing high & low flow days ☑ Minimal maintenance	☒ Sensitive to terrain slope & setback to waterways ☒ Experienced installer required ☒ Not suitable high rainfall areas ☒ Significant capital cost
Option E – ETA evapo-transpiration trenches & beds	☑ Compact system ☑ Complementary trench loading ☑ Balancing high & low flow days ☑ Minimal maintenance	☒ Sensitive to terrain slope & setback to waterways ☒ Experienced installer required ☒ Benching required steep slopes ☒ Significant capital cost

Option B or D are the one to most likely offer the best long-term solution details of which are included in Appendices.

Buffer Distances

Setback buffer distances from effluent land application areas and treatment systems are required to help prevent human contact, maintain public amenity and protect sensitive environments. The relevant buffer distances for this site, taken from Table 5 of the Code (2013) are:

- 50 metre from groundwater bores in sandy soils, 20 metre in clayey soils;
- 100 metre from waterways (potable water supply); and
- 6 metre if area up-gradient and 3 metre if area down-gradient of property boundaries, swimming pools and buildings (conservative values for primary effluent).

All buffer distances are achievable.

Alternative option details are shown in Appendix E.

SPECIAL STORMWATER MEASURES

Stormwater run-on is not expected to be a concern for the proposed irrigation area, due to the landform of the site and its relatively gentle slopes. However, upslope diversion berms or drains may be constructed if this is deemed to be necessary during installation of the system, or in the future.

In selecting suitable areas for effluent dispersal the following constraints were noted:

- Waterway, springs, dams and likely seasonal wet areas;
- Upslope stormwater run-off, groundwater seepage, springs and depressions;
- Unsuitable topographical features, ground conditions and other structures.

Mitigation measures to address stormwater are:

- Diversion of roof drainage away from the effluent dispersal area.
- Construction of cut-off drains or berm for stormwater and/or site drainage.

5. Monitoring, Operation and Maintenance

Maintenance should be carried out in accordance with the EPA Certificate of Approval of the selected secondary treatment system and Council's permit conditions. The treatment system will only function adequately if appropriately and regularly maintained.

To ensure the treatment system functions adequately, residents must:

- Have a suitably qualified maintenance contractor service the secondary treatment system at the frequency required by Council under the permit to use;
- Use household cleaning products that are suitable for septic tanks;
- Keep as much fat and oil out of the system as possible;
- Don't put sanitary or other hygiene products such as baby wipes into the system, and
- Conserve water (3 STAR or better WELS rated fixtures and appliances are recommended).

To ensure the land application area (LAA) functions adequately, residents must:

- Regularly harvest (mow) vegetation within the LAA and remove this to maximise uptake of water and nutrients;
- Monitor and maintain the subsurface irrigation system following the manufacturer's recommendations, including flushing the irrigation lines;
- Regularly clean in-line filters;
- Not erect any structures and paths over the Land application area (LAA);
- Avoid vehicle and livestock access to the LAA, to prevent compaction and damage; and
- Ensure that the LAA is kept uniformly graded by filling any depressions with good quality topsoil (not clay).

Table for recording actions undertaken (✓)

Year/month	Water leaks	Service agent	Monitor effluent	Pump-out (3 yearly)	Effluent ponding	Keep records	Comments -remarks
Frequency recommended	Regularly	As requires	Annually	Every 3 years	Every year	As required	

Note:
A permit condition of the Council approval will require the regular servicing of the *wastewater treatment system* in accordance with manufacturer's instructions.

6. Conclusions

As a result of our investigations it is concluded that sustainable onsite wastewater management is feasible with appropriate mitigation measures, as outlined, for the proposed 3 -bedroom residence at Lot 1, PS117576, 100 Grip Road, TOORA.

Specifically, it is recommended (as per attached site plan & specifications) that you:

- Install a secondary wastewater treatment system of a type approved by EPA;
- Reserve a land application area (LAA) for treated effluent of 220 m^2 (minimum 11m x 20m) mound or trench area (which may be subdivided into many evenly sized zones using an indexing valve);
- Install water saving fixtures and appliances to reduce the effluent load;
- Use of low phosphorus and low sodium (liquid) detergents to improve effluent quality and maintain soil properties for growing plants; and
- Manage the operation and maintenance of the treatment and disposal system in accordance with manufacturer's recommendations, the EPA Certificate of Approval, the EPA Code of Practice (2013) and the recommendations of this report.

Note:

Special stormwater measures as detailed:

- Roof drainage is to be diverted away from any effluent dispersal area.
- Area stormwater to be divert via cut-off drains and/or to site drainage.
- Provide cut-off drains where indicated on site plan.

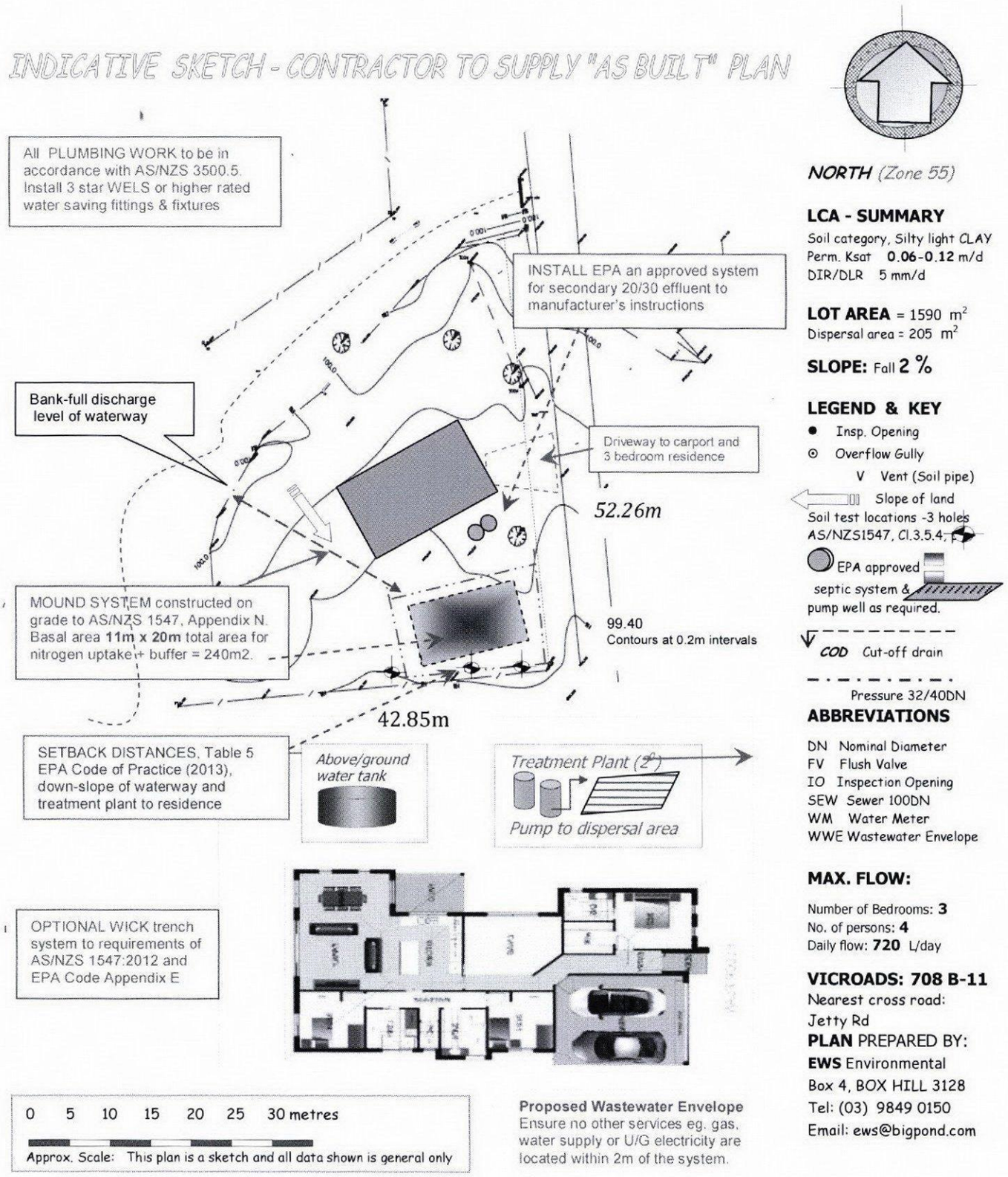


Figure 3 – Site Plan DIMENSIONS IN METRES - DO NOT SCALE REFERENCE: 141016:

7. References

- Environment Protection Authority (2003). Guidelines for *Environmental Management: Use of Reclaimed Water,* Publication 464.2.
- Environment Protection Authority (1991). *Guidelines for Wastewater Irrigation,* Publication 168.
- Environment Protection Authority (2013). Publication 891.3, *Code of Practice for Onsite Wastewater Management.*
- Hazelton, P and Murphy, B. (2007). *Interpreting Soil Test Results – What Do All The Numbers Mean?* CSIRO Publishing, Melbourne
- Isbell, R.F. (1996). The Australian Soil Classification. CSIRO Publishing, Melbourne.
- Municipal Association of Victoria, Department of Environment and Sustainability and EPA Victoria (2014) *Victorian Land Capability Assessment Framework.*
- Standards Australia / Standards New Zealand (2012). AS/NZS 1547:2012 *On-site domestic-wastewater management.*
- USEPA (2002). *Onsite Wastewater Treatment Systems Manual.* United States Environmental Protection Agency.

This assessment has been undertaken in accordance with statutory requirements in:

- Part IV- Septic Tank Systems, *Environment Protection Act 1970*, and
- *State environment protection policies* (Waters of Victoria) and (Groundwaters of Victoria);

8. Acronyms & Definitions

- EPA – Environment Protection Authority, Victoria
- LCA – Land capability assessment
- LAA - Land application area
- LPED – Low pressure effluent distribution
- Reserve area - a duplicate land disposal area reserved for use when the original land disposal area needs to be rested r future unforeseen contingencies.
- Reticulated water - a water supply obtained from mains supply, including any bore, stream or dam.
- Secondary treatment - biological and/or physical treatment following primary treatment of wastewater.
- TP(1) - Test pit (1)
- Unsewered area – land where no sewer pipes are adjacent to the allotment boundaries.
- Waterway – as defined by the Water Act 1989

Appendix A: Soil Bore Log

SOIL BORE LOG

EWS *Environmental* PO Box 4, Box Hill VIC 3128
Email: ews@bigpond.com Telephone: 9849 0150

Client:	*Gary Wallis, 2180 Promontory Rd, Fish Creek*	**Test pit No.**	*TP 1 - TP4*
Site:	*Lot 1, PS117576 Grip Road, TOORA*	Assessor:	*JR Lawrey*
Date:	*24 October 2014*	Excavation:	*Pick & auger*
Notes:	Refer to site plan for borehole positions		

PROFILE DESCRIPTION

Depth (m)	Graphic log	Horizon	Texture	Structure	Colour	Mottles	Coarse fragments	Moisture conditions	Comments
0.10			*SL*		*Black*		*nil*	*damp*	*Organic*
0.20				*Moderate*					
0.30		*TP4*			*Dark brown*				
0.40						*nil*		*damp*	
0.50		*B1*	*SiC*				*<10%*		
0.60									
0.70									
0.80			*SiC*			*nil*			
0.90									
1.00									*Layer continues*
1.10									
1.20									
1.40									
1.60									
1.80									
2.00									

Key to Soil Borelogs

Symbols

W Water table depth
X Depth of refusal

Sample collected

Graphic Log and Textures

S - Sand
S – Loamy sand
CS –Clayey sand

CL – Clay loam
SCL – Sandy clay loam
SiCL – Silty clay loam

Gravel (G)

SL – Sandy loam
SC – Sandy clay
SiC – Silty clay

LC – Light clay
Parent material (stiff)

L - Loam
LFS– Loam fine sandy
SiL – Silty loam

MC – Medium clay
HC – Heavy clay

Parent material (weathered)

Appendix B: Water Balance Calculations for Lot 1, PS117576, 100 Grip Road, TOORA, Ref: 141016, Date: 28 October 2014

Irrigation Area sizing using Nominated Area Water Balance, Nutrient Balance & Storage Calculations

Site Address:	100 Grip Road, TOORA					EWS Ref: 141016	
INPUT DATA				**Date:**	27-Oct-14	**Assessor:**	JR Lawrey *DipCE MIE Aust*
Design Wastewater Flow	Q	720	L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013			
Effluent TN concentration	TN	25	mg/L	Crop N uptake 220 kg/ha/yr equal	60	mgTN/day. Phosphorus sorption capacity not limiting.	
Design Loading Rate	DLR	5.0	mm/day	Based on soil class permeability and derived from Table 9 in EPA Code of Practice (2013).			
Land Application Area	L	240	m sq	Land application area based on limiting factors.			
Crop Factor	C	0.6 -0.8	unitless	Estimates of evapotranpiration as a fraction of pan evaporation; varies over season and crop type.			
Retained Rainfall	RF	0.7	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff.			
Rainfall Data	Rainfall for Toora BOM 85084			Median 941 Design 941	mm	Run-off coefficient grassed areas: < 10% slope 0.90	
Evaporation Data	BOM evaporation chart Tarwin Ea			River Station 85227		> 10 % ...0.85, > 15 % ...0.80, > 20% ...0.75 > 25%. 0.70	

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D	W	days	31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall	R	W	mm/month	51	42	57	71	74	84	82	90	89	80	74	66	860
Evaporation	E	W	mm/month	156	135	96	60	36	24	27	44	64	74	125	124	965
Crop Factor	C			0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.60	0.70	0.80	0.80	0.80	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	125	108	67	42	22	14	16	26	45	59	100	99	724
Percolation	B	DIR x D	mm/month	155	140	155	150	155	150	155	155	150	155	150	155	1825
Outputs		ET+B	mm/month	280	248	222	192	177	164	171	181	195	214	250	254	2549
INPUTS																
Retained design rainfall	RR	R x RF	mm/month	36	29	40	50	52	59	57	63	62	56	52	46	602
Effluent Irrigation	W	(QxD)/L	mm/month	93	84	93	90	93	90	93	93	90	93	90	93	1095
Inputs		RR+W	mm/month	129	113	133	140	145	149	150	156	152	149	142	139	1697
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-151.1	-134.6	-89.3	-52.3	-31.8	-15.6	-20.8	-25.4	-42.5	-65.2	-108.2	-115.0	-369.8
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum Storage	N		mm	0.00												
	V	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	91	92	122	152	179	205	196	189	163	141	109	107	135

MINIMUM AREA REQUIRED FOR ZERO STORAGE: 205 m^2

LAND APPLICATION AREA FOR MOST LIMITING NUTRIENT (Minimum area required with zero buffer setbacks): 240 m2

CELLS

Water Balance

	Enter new data in blue cells
XX	Red cells are automatically populated by the spreadsh
XX	Data in the yellow cells is calculated by the spreadsheet. DO NOT ALTER THESE CELLS

Mound System

MAV model version 891.4 ##########

Water Balance Calculations for Lot 1, PS117576 Grip Road, TOORA, Ref: 141016, Date: 28 October 2014

Victorian Land Capability Assessment Framework

Trench & Bed Sizing

FORMULA FOR TRENCH AND MOUND BED SIZING			Mound base	
L = Q/DLR x W			From AS/NZS 1547:2012	
Where:	Units			
L = Trench or bed length	m	11	Total trench or bed length required	
Q = Design Wastewater Flow	L/day	5	Based on maximum potential occupancy and derived from Table 4, EPA Code of Practice (2013)	
DLR = Design Loading Rate	mm/day	40	Based on soil texture class/permeability and derived from Table 9, EPA Code of Practice (2013)	
W = Trench or bed width	m	8	As selected by designer/installer	
Mound base	m2	88		
INPUT DATA				
Design Wastewater Flow	Q	720	L/day	Based on maximum occupancy and derived from Table 4, EPA Code of Practice (2013)
Design Loading Rate	DLR	40.0	mm/day	Based on soil texture class/permeability from Table 9, EPA Code of Practice (2013)
Trench/mound distribution area	B	18.0	m^2	
Selected trench or bed width	W	3.0	m	As selected by designer/installer
OUTPUT				
Required trench or bed length	L	6.0	m	

RUN-OFF COEFFICIENT :

1. Less than 10% slope 0.90
2. 10 – 15 % 0.85
3. 15 - 20% 0.80
4. 20 - 25% 0.75
5. More than 25% 0.70

MOUND CALCULATIONS

Length	=	22.5	m	Area of distibution bed	=	18	m2
Width	=	8	m	Area at mound base	=	180	m2
Height of mound	=	1.225			=		
Depth of cap	=	0.675	m	Volume of sand required	=	47	m3
Slope 1: n	n =	2					

Length and width of mound from the bottom outside batter

Depth from the base to top of mound

Volume = h / 3 (Atwl + Ab + SQRT (Atwl * Ab)), h = Mound - cap

Irrigation Area sizing using Nominated Area Water Balance, Nutrient Balance & Storage Calculations

Site Address:	100 Grip Road, TOORA				EWS Ref: 141016	
INPUT DATA			**Date:**	27-Oct-14	**Assessor:**	JR Lawrey *DipCE MIE Aust*
Design Wastewater Flow	Q	720	L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013		
Effluent TN concentration	TN	25	mg/L	Crop N uptake 220 kg/ha/yr equal 60 mgTN/day. Phosphorus sorption capacity not limiting.		
Design Loading Rate	DLR	10.0	mm/day	Based on soil class permeability and derived from Table 9 in EPA Code of Practice (2013).		
Land Application Area	L	240	m sq	Land application area based on limiting factors.		
Crop Factor	C	0.6 -0.8	unitless	Estimates of evapotranpiration as a fraction of pan evaporation; varies over season and crop type.		
Retained Rainfall	RF	0.7	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff.		
Rainfall Data	Rainfall for Toora BOM 85084			Median 941 Design 1054 mm		
Evaporation Data	BOM evaporation chart Tarwin Ea			River Station 85227		

Run-off coefficient grassed areas: < 10% slope 0.90
> 10 % ...0.85, > 15 % ...0.80, > 20% ...0.75 > 25%. 0.70

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D	W	days	31	28	31	30	31	30	31	31	30	31	30	31	**365**
Rainfall	R	W	mm/month	51	42	57	71	74	84	82	90	89	80	74	66	**860**
Evaporation	E	W	mm/month	156	135	96	60	36	24	27	44	64	74	125	124	**965**
Crop Factor	C			0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.60	0.70	0.80	0.80	0.80	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	125	108	67	42	22	14	16	26	45	59	100	99	724
Percolation	B	DIR x D	mm/month	310	280	310	300	310	300	310	310	300	310	300	310	3650
Outputs		ET+B	mm/month	435	388	377	342	332	314	326	336	345	369	400	409	4374
INPUTS																
Retained 70th% design rair	RR	R x RF	mm/month	40	33	45	56	58	66	64	71	70	63	58	52	674
Effluent Irrigation	W	(QxD)/L	mm/month	93	84	93	90	93	90	93	93	90	93	90	93	1095
Inputs		RR+W	mm/month	133	117	138	146	151	156	157	164	160	156	148	145	1769
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-301.8	-271.1	-239.5	-196.3	-180.6	-158.5	-168.9	-172.8	-185.0	-213.5	-252.0	-264.5	-1387.8
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Maximum Storage	N		mm	0.00												
	V	Nxl.	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	57	57	67	75	82	87	85	84	79	73	63	62	71

MINIMUM AREA REQUIRED FOR ZERO STORAGE: 87 m^2

LAND APPLICATION AREA FOR MOST LIMITING NUTRIENT (Minimum area required with zero buffer setbacks) 240 m2

CELLS

Water Balance

Enter new data in blue cells

Red cells are automatically populated by the spreadsh

Data in the yellow cells is calculated by the spreadsheet. DO NOT ALTER THESE CELLS

WICK trenching

MAV model version 891.4 ###############

Appendix C: Inspection Report (Commissioning of system)

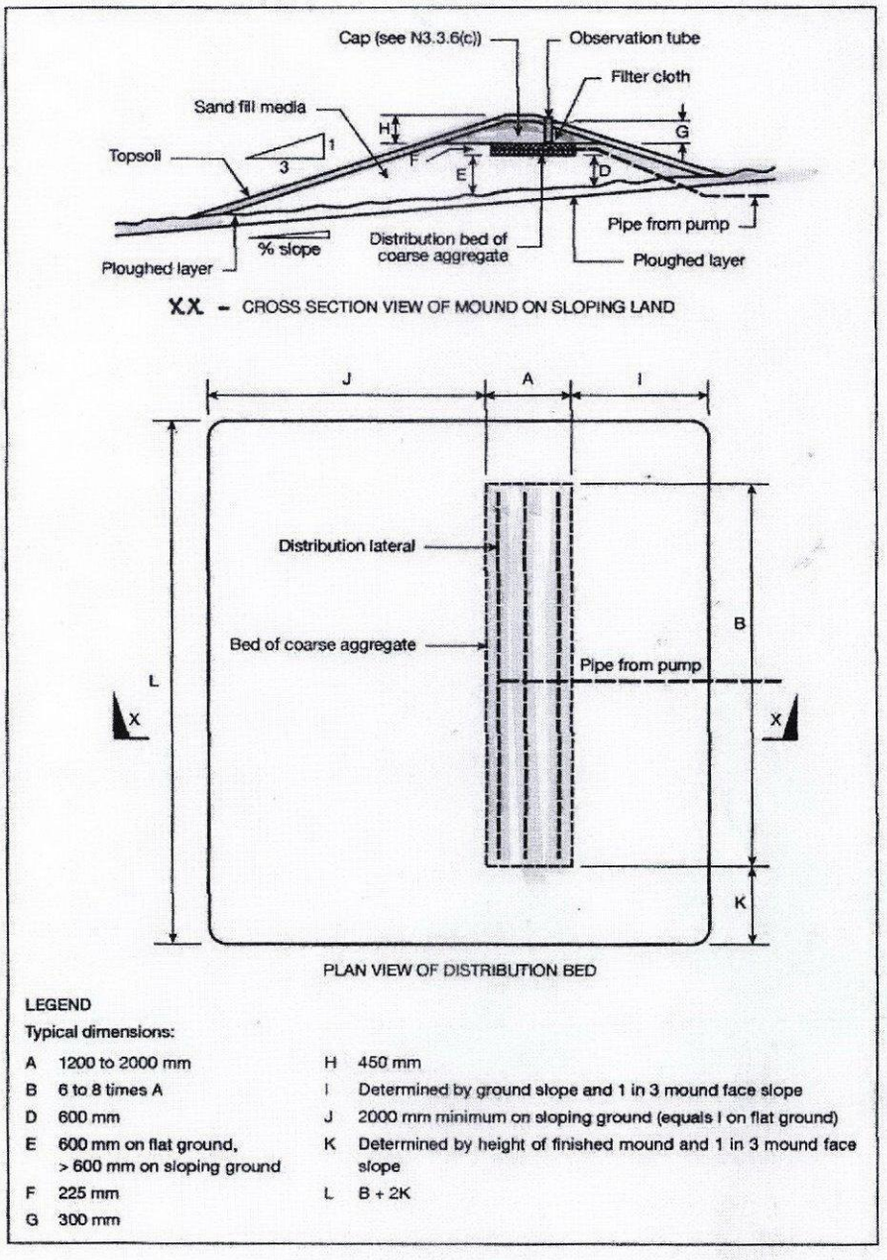
INSPECTION REPORT *(commissioning of onsite wastewater system)*

1	**Property details**	**CHECK HERE**
	Street No. ..... Lot No. ..... Street ..... Suburb/Town ..... Postcode ..... Municipality ..... Map ref:	
	Septic permit issued: Yes/No	
	Permit conditions satisfied: Yes/No	
2	**EPA approved type(s) of system**	CHECK
	Certificate of Approval (EPA) CoA	
	Water appliances/fittings to WELS 3 star rating *where practicable* installed by plumber.	
3	**Excavation & siting of system**	CHECK
	System sited and layout as per permit.	
	Sewer drains laid on correct grades.	
	Exposed soils as expected and have not been compacted or smeared during construction.	
	Grade of beds and trench bottoms on level grade along contour.	
4	**Construction (as applicable)**	CHECK
	Tanks - Treatment tanks have been installed as per manufacturer's instructions.	
	Pumps - High pressure/drip irrigation: 400 W, pressure head as required.	
	Pressurised main to 25-32mm PVC irrigation pipes with flush valves at pipe ends.	
	In-line strainer suitable for effluent irrigation to AS/NZS 1547 specification installed.	
	Pressurised distribution pipes 25- 30 mm with 3 mm holes at 800 mm centres.	
	Distribution drainage pipes covered with geotextile fabric.	
	Appropriate shrubs and/or grass types planted to maximise evapo-transpiration:	
	Distribution pipework is clean.	
	Pump well, alarm system P/O storage and valves tested.	
	Sand Medium: effective size 0.25mm to 0.6mm, Uniformity Co-efficient < 4, Clay < 5%	
	Plastic liner installed in filter system with freeboard around system to prevent infiltration.	
5	**Commissioning**	CHECK
	Installation & commissioning in compliance with instructions.	
	Water appliances and fittings: WELS 3 star rating where practicable.	
	Appropriate vegetation planted, mulched and watered over beds.	
6	**Installed**	
	Installation by:..... Date:	.....

Commissioning report: .....

Date of inspection ..... Date of report .....

Appendix D



LEGEND

Typical dimensions:

A	1200 to 2000 mm	H	450 mm
B	6 to 8 times A	I	Determined by ground slope and 1 in 3 mound face slope
D	600 mm	J	2000 mm minimum on sloping ground (equals I on flat ground)
E	600 mm on flat ground, > 600 mm on sloping ground	K	Determined by height of finished mound and 1 in 3 mound face slope
F	225 mm	L	B + 2K
G	300 mm		

FIGURE N1 WISCONSIN MOUND SYSTEM

Appendix E

EFFLUENT DISPERSAL SYSTEMS
WICK trenches for disposal of effluent to soil with category rating 2, 3, 4 or 5,
categories 1 and 6 require special designs with approved secondary treated effluent.

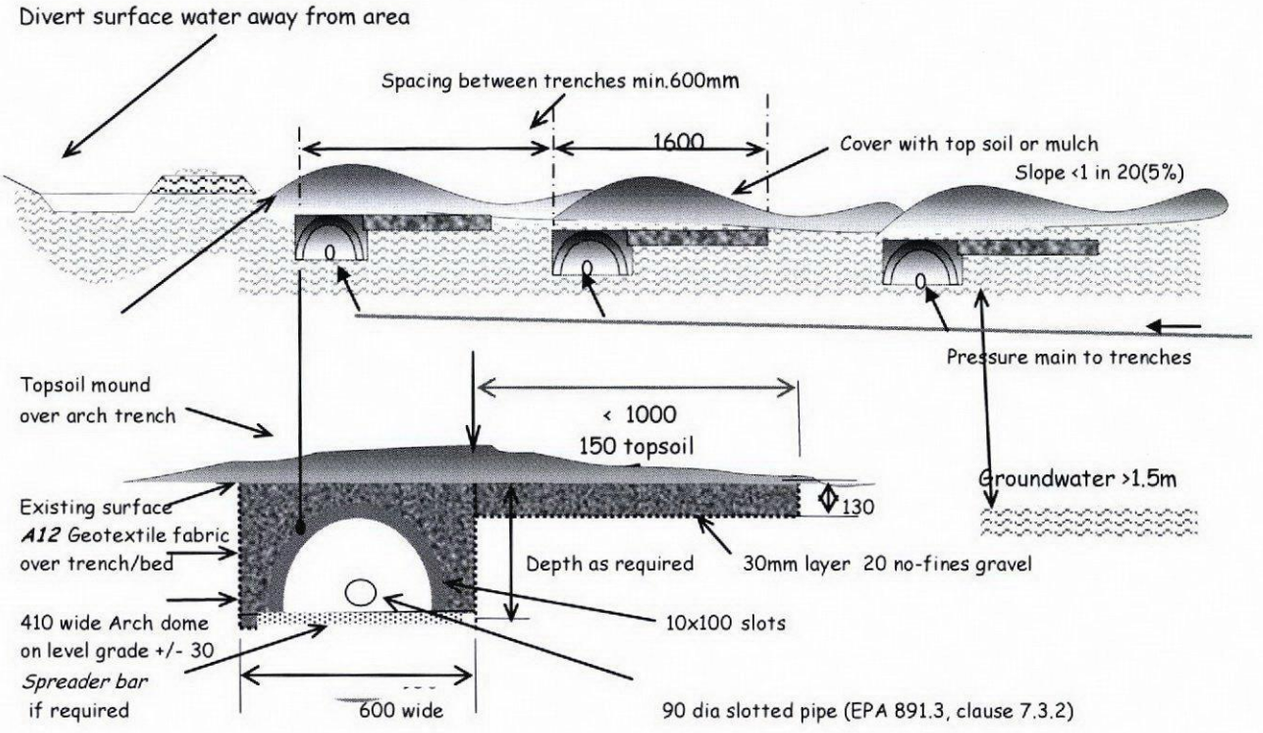
WICK Trench _ Appendix E, EPA Code of Practice Pub. 891.3: 2013

Good construction practice

1. Plan to excavate only when the weather is fine;
2. Avoid excavation when the soil has a moisture content above the plastic limit. This can be tested by seeing if the soil forms a "wire" when rolled between the palms;
3. When excavating by machine, fit the bucket with 'racker teeth' if possible, and excavate in small 'bites' to minimise compaction; and
4. Avoid compaction by keeping people off the finished trench or bed floor.

Note:
- Ensure that inverts are horizontal, and
- Excavate perpendicular to the line of fall or parallel to the contour of sloping ground.

Specifications for Lot 1, PS117576 Grip Road, TOORA, Date: 28 October 2014 Ref: 141016



Section

(all dimensions in millimetres)

Primary or secondary treated effluent

References:

1. EPA Victoria (EPA 2014) *Code of Practice Onsite Wastewater Management*, Publication 891.3.
2. Sydney Catchment Authority (SCA 2012), Designing *and Installing On-site Wastewater Systems.*