

LAND CAPABILITY ASSESSMENT

Ballarat Soil Testing

*Specialising in building site soil classification
and land capability assessments*

Member of FFS and HEDRA

ABN 24 586 140 741

SUMMARY:	
Primary treatment device	3000-3500L septic tank
Secondary treatment device	Sand filter of 18m ² or Aerated Water Treatment System (AWTS) instead of septic tank and sand filter
Land application system	Subsurface irrigation system of 394m ² The drip irrigation system needs to be installed at a depth of 150-250mm <i>in situ</i> or in imported good quality topsoil with a 1m spacing between lines
Loading rate	900L/day
Soil category (AS/NZ 1547:2000)	5b - moderately structured silty clay (light clay)
Design loading rate (DIR)	3mm/day

JOB:	
Reference No	RA060918
Date	September 11, 2018

SITE:	
Proposed development	New dwelling with onsite wastewater treatment system
Property address	Lot 4B Scarsdale - Pitfield Road, Cape Clear
Shire council	Golden Plains Shire Council

PREPARED FOR:	
Client name	Roy Askham
Address	9 Hanwood Close, Delacombe VIC 3356

PREPARED BY:	
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REVIEW:	DATE:	DETAILS:
A	September 11, 2018	Initial draft for submission
B		
C		
D		
E		
F		

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1 Commission

When a property developer, potential buyer or land holder considers subdividing land or building one or more premises, they must first determine whether wastewater can be sustainably managed and absorbed by the land within the property boundaries without negatively impacting the beneficial uses of surface waters and groundwater.

It is the responsibility of the property owner to prove to Council that the proposed onsite wastewater treatment and recycling system will operate sustainably on the property without adverse impacts on public health or the environment.

The objective of this investigation is to conduct a Land Capability Assessment (LCA) and propose a suitable type of onsite wastewater management system for the proposed residential development at the above address.

This document provides a detailed LCA for the allotment, information about the site and soil conditions along with monitoring and management recommendations.

This report has been written to comply with all relevant and current Victorian legislation, guidelines, codes and standards, including:

- AS/NZS 1547:2012, Onsite domestic wastewater management;
- AS/NZS 1547:1994, Onsite domestic wastewater management;
- Code of Practice Onsite Wastewater Management, Publication No. 891.3, February 2013, Environmental Protection Authority;
- Land Capability Assessment for Onsite Domestic Wastewater Management, Publication 746.1, March 2003, EPA Victoria;
- Victorian Land Capability Assessment Framework, January 2014, Municipal Association of Victoria.

2 Locality and site description

2.1 The site

	Site shape, dimensions, size, gradient and drainage
The site has a total area of:	2730.539 m ²
The ground surface is:	Lightly undulating
The gradient of the site is:	Slight slope falling to southeast
The drainage on site is:	Fair

	Existing use and development on the site
The current use of the site is:	Vacant
The buildings or works located on the site are:	N/A

	Existing access arrangements
The main vehicle access to the site is provided from:	Scarsdale - Pitfield Road
The space available for vehicle maneuverability can be considered:	Fair
The site is located:	Please refer to Appendix 1.

	Existing vegetation
Describe the vegetation on the site, including the type, location, extent and any other relevant information:	Grasses across site

2.2 The locality and surrounding land

	Existing use and development on adjacent sites
Describe the land and existing land uses around the subject land:	Township zone (TZ). Residential to north and south.

3 Proposed development

3.1 Construction

	Building
The proposed building on site is:	New dwelling with onsite wastewater treatment system
The number of bedrooms/study is proposed to be:	Four (4) bedrooms
The maximum occupancy is proposed to be:	Five (5) persons

3.2 Wastewater

	Target effluent quality
Wastewater system:	Aims to achieve the target effluent quality of BOD <20 mg/L and SS <30mg/L.
Anticipated wastewater load:	<p>Daily household wastewater generation is estimated by multiplying the potential occupancy, which is based on the number of bedrooms (plus one person), by the Minimum Wastewater Flow Rates.</p> <p>Assessments should include any additional room(s) shown on the house plan such as a study, library or sunroom that could be closed off with a door, as a bedroom for the purposes of the following calculations.</p> <p>Assuming construction of a new four-bedroom dwelling, normal fixtures, five (5) people maximum occupancy and wastewater generation of 180L/day/person.</p> <p>Therefore: Total Design Load = 900L/day</p>

3.3 Intended water supply and sewer source

	Services
Domestic water supply	No reticulated water supply is likely to be provided in the short to medium term future.
Availability of sewer	No town sewerage system is likely to be connected in the short to medium future.

4 Site and soil assessment

4.1 Work undertaken

	Assessment
Assessor:	Stephen O'Loughlin
Date:	September 11, 2018

4.2 Site assessment

Feature	Description	Level of constraint	Mitigation measures
Aspect (affects solar radiation received)	North	Nil	NN
Climate (difference between annual rainfall and pan evaporation)	Excess of rainfall over evaporation in the wettest months	Major	Irrigation area sizing using the Nominated Area Water Balance & Storage Calculations allows for the wettest recorded months
Erosion (or potential for erosion)	Nil	Nil	NN
Exposure to sun and wind	Full sun	Nil	NN
Fill (imported)	No fill	Nil	NN
Flood frequency (ARI)	Less than 1 in 100 years	Nil	NN
Groundwater bores	Setback distance from bore complies with requirements in EPA Code of Practice 891.3 (as amended)	Moderate	Setback distances to be complied with
Land area available for LAA	Exceeds LAA and duplicate LAA and buffer distance requirements	Nil	NN
Landslip (or landslip potential)	Nil	Nil	NN
Rock outcrops (% of surface)	<10%	Nil	NN
Slope Form (affects water shedding ability)	Straight side-slopes	Minor	NN

Slope gradient (%)			
(a) for absorption trenches and beds	<6%	Nil	NN
(b) for surface irrigation	<6%	Nil	NN
(c) for subsurface irrigation	<10%	Nil	NN
Soil Drainage (qualitative)	Some signs or likelihood of dampness	Moderate	Irrigation area sizing using the Nominated Area Water Balance & Storage Calculations allows for the wettest recorded months
Stormwater run-on	Low likelihood of stormwater run-on	Nil	NN
Surface waters - setback distance (m)	Setback distance complies with requirements in EPA Code of Practice 891.3 (as amended)	Nil	NN
Vegetation coverage over the site	Limited variety of vegetation	Moderate	Lawn grasses to be planted in proposed effluent field area
Soil Drainage (Field Handbook definitions)	Moderately well drained. Water removed somewhat slowly in relation to supply, some horizons may remain wet for a week or more after addition	Moderate	Shallow subsurface irrigation recommended with thorough water balance calculated.

*NN: not needed

4.3 Soil key features

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

4.4 Geology

	Geological mapping
Geological Survey Code:	Qno1
Description:	Sheet flow basalts: numerous superimposed flows with interbasaltic sediment; vents generally discernible, lateral streams developed, positively magnetized; dominantly weathered tholeiite to mildly alkalic olivine-basalt.
Reference:	TAYLOR, D.H., 1996. Rokewood 1:50,000 geological map. Geological Survey of Victoria.

4.5 Local Mine Hazards

	DPI Search for Mine Hazard results
Department of Primary Industries records:	"do not indicate the existence of any mining activity on or under this site, but the site is within an area of past prospecting or mining activity. Note that there may be unrecorded mine workings present."

4.6 Soil

	Soil conditions
The predominant soil profile on site is:	Shallow silty loam overlying stiff silty clay.
Sample hole results:	Please refer to Attachment 4 for sample hole results.

4.7 Soil profile determination

	Assessment
Field work	Two (2) boreholes were established and excavated in the area of the proposed building and wastewater management system.
Method of drilling or excavation	Trailer-mounted soil sampling machine.
Method of classification	The soil was classified according to AS/NZS 1547-1994/2012 while considering Cape Clear's temperate climate.
Site and test plan	Please refer to Attachment 2.
Reporting	Please refer to Attachment 4.

4.8 Soil assessment

Feature	Assessment	Level of Constraint	Mitigation Measures
Soil category (AS/NZ 1547:2012)	4a - moderately structured clay loam overlying 5b - moderately structured silty clay (light clay).		
Soil depth	Topsoil: 200mm	Minor	Shallow subsurface irrigation in topsoil recommended
	Subsoil: >200mm	Minor	NN

Soil Permeability & Design Loading Rates	Subsoil: 5b - moderately structured silty clay (light clay): 0.06 - 0.12 m/day saturated conductivity (K_{sat}) (AS/NZS1547:2012); 3.5 mm/day Design Loading Rate (DLR) for irrigation system and 3 mm/day Design Loading Rate (DIR) for irrigation system (Code of Practice, 2013).	Moderate	Use conservative DIR = 3mm/day in calculations
Mottling	Moderately well to imperfectly drained soils have grey and/or yellow brown mottles and in the mottled areas occur higher in the profile the less well drained the soil.	Moderate	Irrigation area sizing using the Nominated Area Water Balance & Storage Calculations allows for the wettest recorded months
pH	5.5 - 8 is the optimum range for a wide range of plants	Nil	NN
Rock Fragments	0 – 10%	Nil	NN
Soil Depth to Rock or other impermeable layer	>1.5 m	Nil	NN
Soil Structure (pedality)	Moderately-structured	Nil	NN
Soil Texture, Indicative Permeability	5b, 5c	Major	Use conservative DIR = 3mm/day in calculations
Watertable Depth (m) below the base of the LAA	>2m	Nil	NN

4.9 Golden Plains Shire Domestic Wastewater Management Plan Assessment

	Assessment
Rainfall Risk Rating:	Low Risk
Soil Risk Rating:	Low Risk
Slope Risk Rating:	Low Risk (<20%)
Groundwater Risk Rating:	Low Risk Area
Catchment Area:	Outside Designated Water Supply Catchment Area

4.10 Groundwater Assessment

	DEPI Groundwater Data Search
Department of Environment and Primary Industries records:	Groundwater depth: 5 to 10m Groundwater salinity: 3500 – 7000mg/l

4.11 Victorian Planning Provision – Overlays

Overlay	Assessment
Planning Zone:	TOWNSHIP ZONE (TZ)
Planning Overlay:	HERITAGE OVERLAY (HO)

4.12 Overall assessment results and land capability rating

Based on the most constraining site features (climate/rainfall) and soil assessment (soil type), the overall land capability of the proposed effluent management area is constrained. However, the effluent management system will be designed, installed and maintained in ways which will mitigate these factors.

The proposed effluent management area is located above the 1:100 flood level and by using secondary treatment and pressure-compensating sub-surface irrigation, there will be ample protection of surface waters and groundwater.

5 Wastewater management system

5.1 Overview

This report provides recommendations for treatment and land application systems that are appropriate to the land capability. The following sections provide an overview of a suitable system, with sizing and design considerations and justification for its selection. Detailed design for the system is beyond the scope of this study, but should be undertaken at the time of building application and submitted to Council.

5.2 Type of treatment system

Sand Filter or Aerated Water Treatment System (AWTS)

To treat domestic wastewater and allow irrigation with the treated effluent, we recommend installing a system that provides secondary treatment with disinfection to meet Environmental Protection Authority requirements for irrigation. Indicative target effluent quality is:

- BOD <20 mg/L;
- SS <30mg/L.

Several suitable options are available, including a **sand filter or aerated water treatment system (AWTS)**. Any of these options are capable of achieving the desired level of performance and final selection is the responsibility of the property owner, who will forward details to Council for approval.

5.3 Sizing the sand filter system

To determine the necessary size of the design area, the sizing relationship from AS/NZS 1547:1994 has been used:

$$\text{Area of Sand Filter} = \frac{Q}{50L/d}$$

where

Q = Quantity of wastewater (L/d)

$50L/d$ = Sand filter acceptance rate

Number of bedrooms	Number of occupants	Total daily household wastewater	Area of sand filter
3	4	720	15m ²
4	5	900	18m ²
5	6	1080	22m ²

5.4 Alternative type of treatment system

Aerated Water Treatment System (AWTS)

To treat domestic wastewater and allow irrigation with the treated effluent, we recommend installing a system that provides secondary treatment with disinfection to meet Environmental Protection Authority requirements for irrigation. The water quality of secondary standard effluent in Victoria is $<20 \text{ mg/L BOD}_5$, $<30 \text{ mg/L TSS}$ and, where disinfected, *E. coli* $<10 \text{ cfu /100 mL}$.

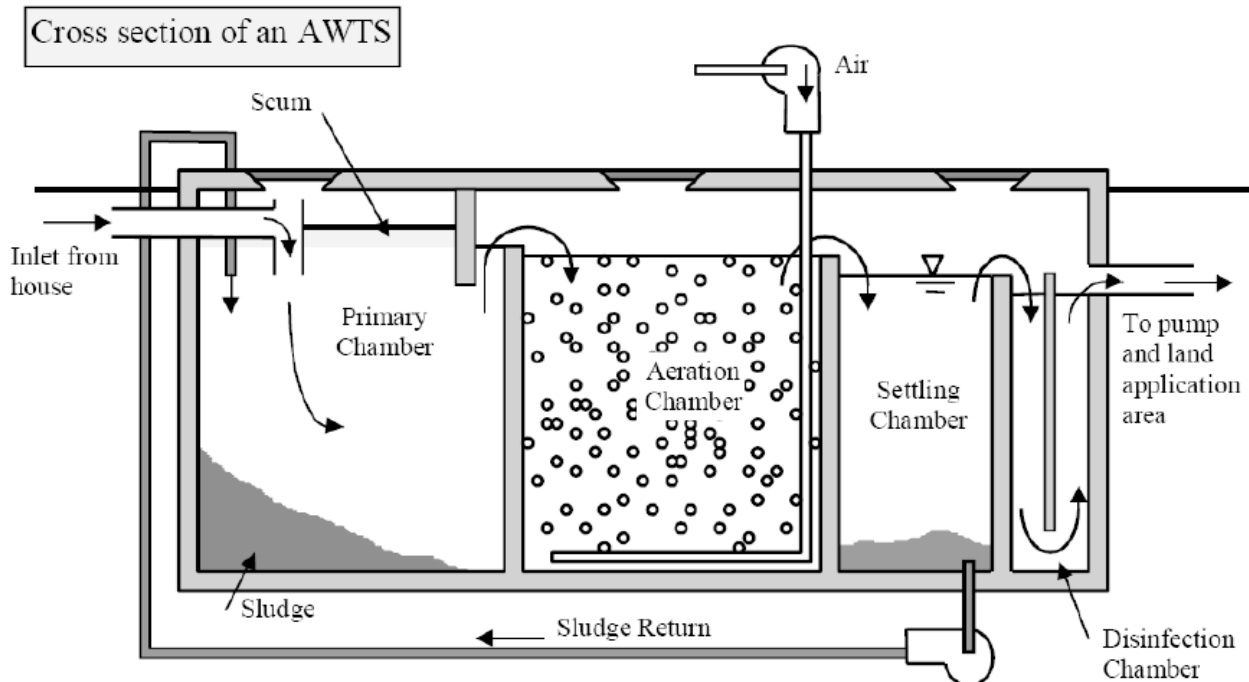
An **Aerated Water Treatment System (AWTS)** is the preferred option and is designed to treat small ($<2000\text{L/day}$) wastewater flows. This system consists of a series of treatment chambers combined where air is bubbled through wastewater in a tank provides oxygen to micro-organisms to facilitate aerobic biological digestion of the organic matter in the wastewater.

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 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.



5.5 Type of land application system

Pressure compensating subsurface irrigation system

The default land application system for sustainably recycling secondary treated sewage or greywater effluent to land is **pressure-compensating sub-surface irrigation** (with disc or mesh filters and scour and vacuum valves) which evenly distributes effluent throughout the irrigation area.

The distribution pipes (drip-lines) fill up with effluent until a certain pressure is reached which opens the emitter valves. More controlled pressure can be applied when the field is divided into two or more zones and these smaller areas are intermittently dosed using a sequencing valve.

Water is not wasted by evaporation or runoff, flexible garden designs are possible, water is delivered to the plants' roots in the topsoil layer and it provides the highest protection for environmental and public health.

In combination with the selected secondary treatment system, these systems will provide even and widespread dispersal of highly treated effluent loads within the root-zone of plants.

Secondary quality effluent is a valuable water and nutrient resource and should be used beneficially to support vegetation growth, not be discharged deep in the soil profile where it provides very little beneficial use to the land or to the residents.

A gravity-flow effluent irrigation system is not allowed, due to the lack of even distribution. Irrigation distribution pipes must not have dripper-holes drilled or cut into them after purchase because the effluent will flow out of the holes in the first few metres of pipe at a far higher rate than the system is designed for and higher than the soil is capable of sustainably absorbing.

5.6 Sizing the irrigation system

To determine the necessary size of the effluent field system, water balance modelling has been undertaken using the method and water balance tool developed for the Victorian Land Capability Assessment Framework (2014). The calculations are summarised below, with full details provided in Attachment 5.

The water balance can be expressed by the following equation:

$$\text{Precipitation} + \text{Effluent Applied} = \text{Evapotranspiration} + \text{Percolation}$$

	Data used in the water balance
Mean monthly rainfall station	Rokewood (89068)
Mean monthly pan evaporation station	Rokewood (89068) - SILO
Average daily effluent load	900L/day
Design loading rate (DLR)	3.5mm/day
Design irrigation rate (DIR)	3mm/day
Crop factor	0.6 to 0.8
Rainfall runoff factor	0.8

Size

As a result of these calculations, a subsurface irrigation field of at least $394m^2$ is required for a proposed four (4) bedroom dwelling on this site.

Number of bedrooms	Number of occupants	Total daily household wastewater	Area of subsurface irrigation bed
3	4	720	$315m^2$
4	5	900	$394m^2$
5	6	1080	$473m^2$

5.7 Siting and configuration of the irrigation system

Description

It is preferable to keep the irrigation area as high on the property as possible and a maximum distance from the boundaries as setbacks allow. The preferred area is to the northwest of the proposed dwelling.

Attachment 3 shows an envelope of land that is suitable for effluent management, although this envelope is much larger than the minimum required. Final placement and configuration of the irrigation system will be determined by the client and/or system installer, provided it remains within this envelope.

Whilst there is ample area for application of the effluent, it is important that appropriate buffer distances to the waterways be maintained. It is important to note that buffers are measured as the overland flow path for run-off water from the effluent irrigation area.

It is recommended that the owner consult an irrigation expert familiar with effluent irrigation equipment to design the system, and an appropriately registered plumbing/drainage practitioner to install the system. The irrigation plan must ensure even application of effluent throughout the entire irrigation area.

5.8 Buffer distances

Description

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:

- 30 metres from non-potable watercourses; and
- 3 metres if area up-gradient and 1.5 metres if area down-gradient of property boundaries, swimming pools and buildings (conservative values for primary effluent).

All buffer distances are achievable.

The site plan in Attachment 3 shows the location of the proposed wastewater management system components and other relevant features.

5.9 Installation of the irrigation system

Description

Installation of the irrigation system must be carried out by a suitably qualified, licensed plumber or drainer experienced with effluent irrigation systems.

To ensure even distribution of effluent, it is essential that the pump capacity is adequate for the size and configuration of the irrigation system, taking into account head and friction losses due to changes in elevation, pipes, valves, fittings etc. An additional, optional measure to achieve even coverage is to divide the irrigation area into two or more separate sub-zones; dosed alternately using an automatic indexing or sequencing valve.

The irrigation area and surrounding area must be vegetated or revegetated immediately following installation of the system, preferably with turf. The area should be fenced or otherwise isolated (such as by landscaping), to prevent vehicle and stock access; and signs should be erected to inform householders and visitors of the extent of the effluent irrigation area and to limit their access and impact on the area.

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. Stormwater from roofs and other impervious surfaces must not be disposed of into the wastewater treatment system or onto the effluent management system.

5.10 Monitoring, operation and maintenance

Description

Maintenance is to be carried out in accordance with Australian Standards 1546.1 to 1546.4 pursuant to 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 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; and
- Conserve water (AAA rated fixtures and appliances are recommended).

To ensure the land application system 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 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 LAA;
- Avoid vehicle and livestock access to the LAA, to prevent compaction and damage; and
- Ensure that the LAA is kept level by filling any depressions with good quality topsoil (not clay).

6 Conclusions

As a result of our investigations we recommend that a sustainable onsite wastewater management system can be built to meet the needs of a new four-bedroom dwelling at Lot 4B Scarsdale - Pitfield Road, Cape Clear.

Specifically, we recommend the following:

- Secondary treatment of wastewater in an aerobic sand filter system consisting of a septic tank for (primary) and a $18m^2$ sand bed for (secondary);
 - Alternatively, an Aerated Water Treatment System (secondary treatment);
- Land application of wastewater in a $394m^2$ pressure compensating subsurface irrigation area;
- Location of Land Application Area northwest of proposed building envelope;
- Moderately structured 5b - moderately structured silty clay (light clay) should be considered to have a DLR of $3.5mm/d$ and a DIR of $3mm/d$;
- Installation of water saving devices in the new residence to reduce the effluent load for onsite disposal;
- Use of low phosphorus and low sodium (liquid) detergents to improve effluent quality and maintain soil properties; and
- Operation and management of the treatment and disposal system in accordance with manufacturer's recommendations, Australian Standards 1546.1 to 1546.4 pursuant to the selected secondary treatment system, the EPA Code of Practice (2013) and the recommendations made in this report.

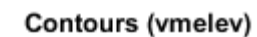
If there are any queries regarding the content of this report please contact this office.



STEPHEN O'LOUGHLIN
Geologist

Attachment 1 – Locality plan

Plan included on next page.



Major Contour

Minor Contour

Roads (vmtrans)

Freeway

Highway

Main Road

Other

- Lakes (vmhydro)

Watercourses (vmhydro)

Rivers

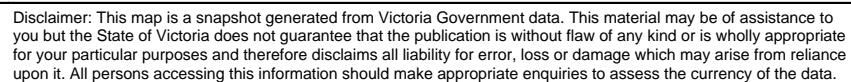
Creeks

Other

**Victoria Boundary
(25K)**

Boundary

Coastline

Property - Address

Generated from GeoVic 3

Map Created Tue Sep 11 2018 17:07:57 GMT+1000 (AEST)

Map Scale: 1:4,312

Projection: MGA 54




Attachment 2 – Soil testing program plan

Plan included on next page.

Soil sampling program

Lot 4B Scarsdale - Pitfield Road, Cape Clear

Legend

 Sample hole

 BH02

 BH01

Google Earth

Image © 2018 DigitalGlobe



50 m

Attachment 3 – Proposed wastewater treatment site

Plan included on next page.



ATTACHMENT 3: PROPOSED WASTEWATER TREATMENT SITE

Lot 4B Scarsdale - Pitfield Road, Cape Clear



Attachment 4 – Sample hole results

Sample Hole BH01

Depth (mm)	Description	Fill	Moisture	Consistency	Allowable Bearing Pressure (kPa)	Reactivity
100 200	Silty LOAM; dark brown	–	Slightly moist	Firm	–	–
300 400 500 600 700 800	Silty CLAY; brown/red; dark grey mottling	–	Slightly moist	Stiff	130	High
900 1000	Sandy CLAY; light brown/orange; minor quartz gravel	–	Slightly moist	Stiff	150	High
1100 1200 1300 1400 1500	END OF HOLE					

Sample Hole BH02

Depth (mm)	Description	Fill	Moisture	Consistency	Allowable Bearing Pressure (kPa)	Reactivity
100 200	Silty LOAM; dark brown; quartz gravel	–	Slightly moist	Firm	–	–
300 400 500 600 700 800 900	Silty CLAY; brown/dark grey/red	–	Slightly moist	Stiff	130	High
1000 1100	Sandy CLAY; orange/white; minor quartz gravel	–	Slightly moist	Stiff	150	High
1200 1300 1400 1500	END OF HOLE					

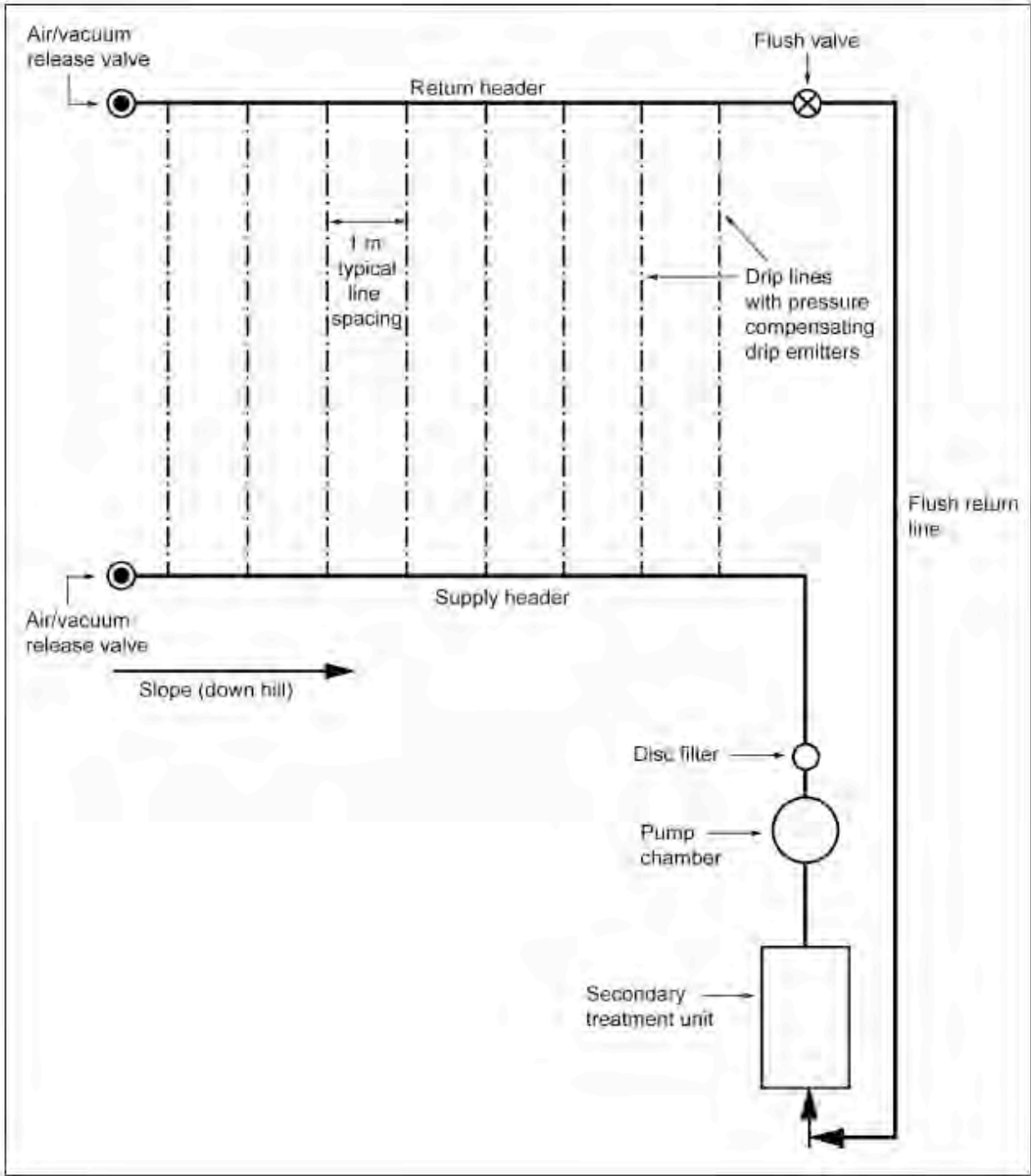
Attachment 5 – Water balance calculations

Spreadsheets included on next page.

Victorian Land Capability Assessment Framework

Please read the attached notes before using this spreadsheet																
Irrigation area sizing using Nominated Area Water Balance & Storage Calculations																
Site Address:		Lot 4B Scarsdale - Pitfield Road, Cape Clear														
Date:		September 11, 2018				Assessor:		S. O'Loughlin - Ballarat Soil Testing								
INPUT DATA																
Design Wastewater Flow	Q	900	L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013)												
Design Irrigation Rate	DIR	3.0	mm/day	Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (2013)												
Nominated Land Application Area	L	394	m ²	1												
Crop Factor	C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type ²												
Rainfall Runoff Factor	RF	0.8	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff												
Mean Monthly Rainfall Data	Rokewood (89068)			BoM Station and number												
Mean Monthly Pan Evaporation Data	Rokewood (89068) - SILO			BoM Station and number												
Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall	R		mm/month	33.0	33.8	38.5	42.6	45.0	46.5	45.5	56.6	62.6	57.4	50.6	43.6	555.7
Evaporation	E		mm/month	152.5	127.1	104.8	63.9	39.1	26.4	30.1	43.4	62.1	92.4	114.9	141.7	998.3
Crop Factor	C		unitless	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	122	102	73	45	23	16	18	26	43	74	92	113	747.776
Percolation	B	DIRxD	mm/month	93.0	84	93.0	90.0	93.0	90.0	93.0	93.0	90.0	93.0	90.0	93.0	1095.0
Outputs		ET+B	mm/month	215.0	185.696	166.3	134.7	116.4	105.8	111.0	119.0	133.5	166.9	181.9	206.3	1842.8
INPUTS																
Retained Rainfall	RR	RxRF	mm/month	26.4	27.04	30.8	34.08	36	37.2	36.4	45.28	50.08	45.92	40.48	34.88	444.56
Applied Effluent	W	(QxD)/L	mm/month	70.8	64.0	70.8	68.5	70.8	68.5	70.8	70.8	68.5	70.8	68.5	70.8	833.8
Inputs		RR+W	mm/month	97.2	91.0	101.6	102.6	106.8	105.7	107.2	116.1	118.6	116.7	109.0	105.7	1278.3
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	-117.8	-94.7	-64.7	-32.1	-9.6	-0.1	-3.8	-2.9	-14.9	-50.2	-72.9	-100.6	
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	
Maximum Storage for Nominated Area	N		mm	0.00												
	V	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE				m ²	148	159	206	268	347	393	374	378	324	231	191	163
MINIMUM AREA REQUIRED FOR ZERO STORAGE:					394.0	m ²										
CELLS																
		Please enter data in blue cells														
		XX Red cells are automatically populated by the spreadsheet														
		XX Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS														
NOTES																
¹ This value should be the largest of the following: land application area required based on the most limiting nutrient balance or minimum area required for zero storage																
² Values selected are suitable for pasture grass in Victoria																

Attachment 6 – Subsurface irrigation system example



Attachment 7 – Reducing Wastewater

In accordance with the principles of the waste hierarchy, the following steps are recommended to limit the amount of wastewater generated and beneficially use the resultant water resource onsite:

	Suggestions
1. Avoid generating excess wastewater by:	<ul style="list-style-type: none"> a) constructing a house with fewer bedrooms b) installing a dry composting toilet c) not installing a spa d) not installing a bath (low flow rate shower only) e) not installing a kitchen food waste grinder.
2. Reduce the volume of wastewater generated by installing:	<p>High 'Water Efficiency Labelling Scheme' (WELS)-rated water-efficient fittings (minimum '3 Stars' for appliances and minimum '4 Stars' for all fittings and fixtures):</p> <ul style="list-style-type: none"> a) water-efficient clothes washing machines (front or top loading) b) dual-flush (6.5/3.5L or less) toilets c) water-efficient shower roses d) water-efficient dishwashers e) aerated taps f) hot and cold water mixer taps (especially for the shower) g) flow restrictors h) hot water system fitted with a 'cold water diverter' which recirculates the initial flow of cold water until it is hot enough for a shower.
3. Reuse (another use without any treatment) wastewater by:	<ul style="list-style-type: none"> a) washing fruit and vegetables in tap water in a container and reusing the water for another purpose in the house such as watering pot plants b) collecting the initial cold water from showers in buckets and using it for another purpose such as soaking feet, hand washing clothes or washing the car on the lawn.
4. Recycle wastewater after treatment by using it to:	<ul style="list-style-type: none"> a) water gardens and lawn areas b) flush toilets with effluent from an EPA-approved 10/10/10 greywater system c) supply effluent to the cold water tap of the washing machine from an EPA-approved 10/10/10 greywater treatment system