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LAND CAPABILITY ASSESSMENT REPORT

FOR THE PROPERTY AT

171 Wilsons Lane YANDOIT

REPORT NUMBER: 2200682-2

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CLIENT	**:**	Made For 31 Rupert Street COLLINGWOOD VIC 3066
PROJECT ADDRESS	**:**	171 Wilsons Lane YANDOIT
REPORT NUMBER	**:**	2200682-2
TESTING DATE	**:**	02 November 2020

1. INTRODUCTION:

Civiltest Pty Ltd (Civiltest) have been engaged to undertake a Land Capability Assessment (LCA) for an approximately 134131m^2 site at 171 Wilsons Lane YANDOIT. The site is currently developed with an existing three bedroom dwelling. It has been proposed to construct an additional three bedroom dwelling on the allotment.

This report will address:

- The capability of the site to sustainably manage wastewater within the allotment boundaries;
- A management program that should be put into place to minimise health and environmental impacts of on-site wastewater management, including the impact on surface water and groundwater (EPA, 2003a); and
- Information about the site and soil conditions.

2. SITE KEY FEATURES:

Site Address	171 Wilsons Lane YANDOIT
Owner/Applicant	Made For
Local Council	Hepburn Shire
Total Land Area	Approximately 134131m^2
Domestic Water Supply	Reticulated/Tank
Anticipated wastewater loads (Litres/day) [1] [2]	Assumed two 3 bedroom residences, up to 8 people. 1. Households with standard water reduction facilities: EPA {(No. of bedrooms) + 1 } x 180 = 1260L/day 2. Households with full water reduction facilities: EPA: 150L/person = 1050L/day **Anticipated daily wastewater = 1260L**
Organic Material Loading Design Rates	BOD / 60g per person, total is number of bedrooms plus one, therefore 8 x 60g = 480g
Availability of sewer	The availability of the sewer is not likely in the foreseeable future
Groundwater Quality	Groundwater is classified as category C - Stock use (TDS 3501-13000mg/L). www.dpi.vic.gov.au/vro

[1] Note WELS rated water reduction fixtures and fittings – minimum 4 stars dual flush toilets, shower flow restrictions, aerator taps and a minimum of 3 stars for appliances.

[2] The daily wastewater loads are estimated by multiplying the potential occupancy which is based on the number of bedrooms plus one person. This is then multiplied by the minimum wastewater loads in Table 4 EPA 891.4.

2.1 Locality Plan

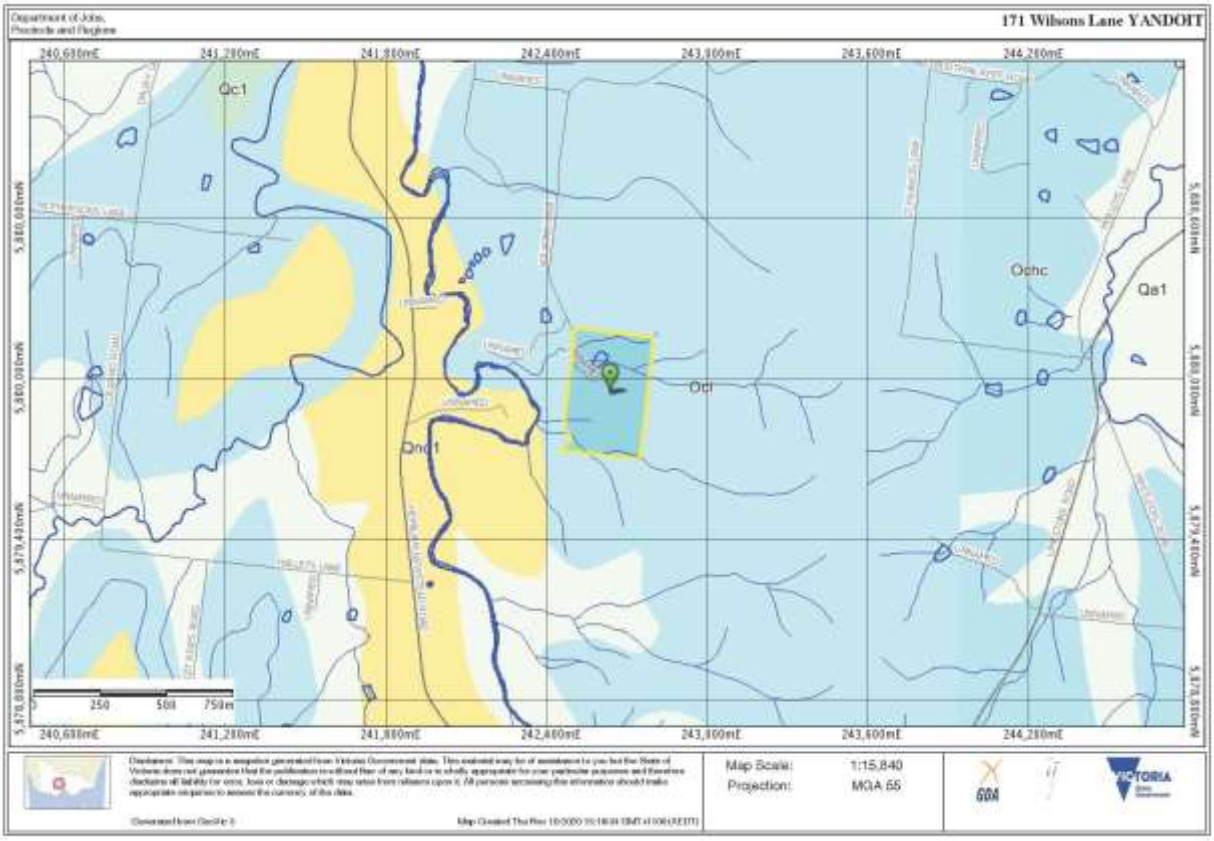
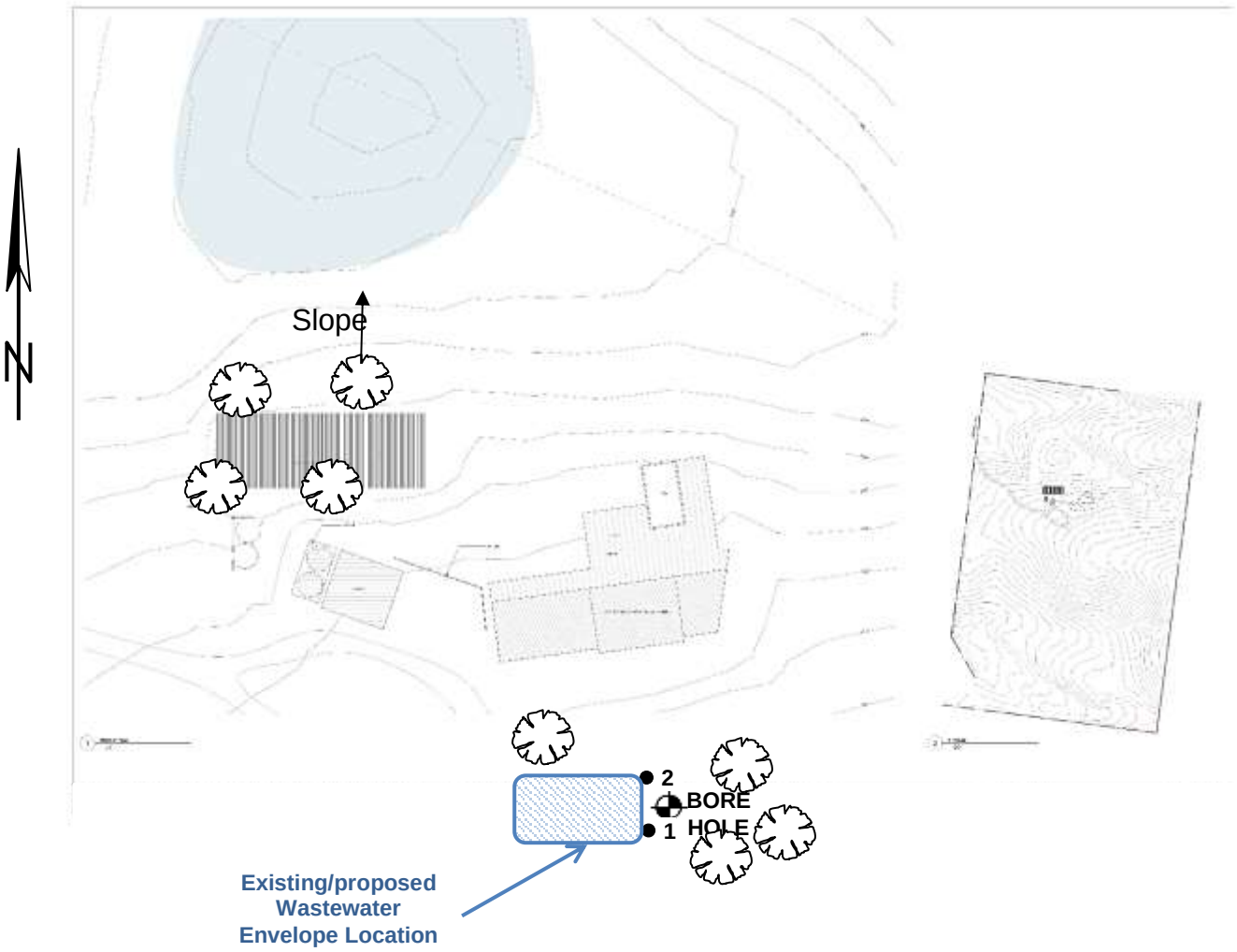


Figure 1 – Site Locality (Including local geology) www.dpi.vic.gov.au

Figure 2 – Site Plan



Denotes Bore Hole

Denotes Test Holes

NOT TO SCALE

SITE FEATURES	
Climate	The average rainfall is 622mm per year
Flood Potential	Lower areas may be prone to inundation however wastewater field elevated above potential to flooding
Vegetation	Natural grasses and native trees
Water Table	Held deep within the ROCK
Exposure	High sun and wind exposure
Slope	6%
Landform	Low hills 30 – 90m
Approximation to water course	Existing dam onsite
Erosion Potential	Minor
Surface Drainage	Adequate slope, moderate drained soils
Land Area	Approximately 134131m^2
Rocks and Rock Outcrop	Rock observed at surface
Geology	Ordovician Sediment – CLAYS belonging to Castlemain Group

2.2 Table - Site Features

There are no critical issues identified above however setback distances from the existing dam must be considered.

3. SOIL ASSESSMENT AND CONSTRAINTS:

3.1 Published Soils Information

The soils have been derived from the weathering of Ordovician aged sedimentary ROCK within a semi-arid climate.

3.2 Site Exposure

A general assessment of the site exposure is as follows:

The site is exposed to the prevailing winds. The proposed effluent disposal area is generally exposed to sun and wind all year round.

3.3 Soil Assessment

BORE HOLE	**SAMPLE DEPTH:** 300mm	
SOIL ASSESSMENT (AS1547-2012)	**SOIL HORIZON:** A	
Soil Colour	Pale brown	
Soil Texture	Loam	
Coarse Fragments (%)	10%	
Soil Structure	Weak	
Soil Dispersion	Class 5	
Soil Permeability	0.5-1.5m/d	
Soil Category	3b	
Design Irrigation Rate	10mm/d	
pH 1:5 Ratio Electronic Method	6.45	
Electrical Conductivity	029µS/cm	/1000 = 0.029dS/m
Salinity Hazard	Non saline – Class 1	

BORE HOLE	**SAMPLE DEPTH:** 600mm	
SOIL ASSESSMENT (AS1547-2012)	**SOIL HORIZON:** B	
Soil Colour	Orange brown	
Soil Texture	Light clay	
Coarse Fragments (%)	10%	
Soil Structure	Strong	
Soil Dispersion	Class 5	
Soil Permeability	0.12-0.5m/d	
Soil Category	5a	
Design Loading Rate	5mm/d	
pH 1:5 Ratio Electronic Method	6.50	
Electrical Conductivity	047µS/cm	/1000 = 0.047dS/m
Salinity Hazard	Non saline – Class 1	

4. FIELD ASSESSED PERMEABILITY:

An investigation on the soil profile was assessed in-situ and permeability testing conducted as outlined in AS 1547-2012 using the constant-head test method. The constant-head test was conducted in four locations across the site (see plan, Figure 2). The field assessed permeability was calculated using the Talsma-Hallam constantly maintained head of water equation identified in AS 1547-2012.

$$K_{sat} = \frac{4.4\ Q\ [0.5\sinh^{-1}(H/2r) - \sqrt{\{(r/H)^2 + 0.25\}} + r/H]}{2\pi H^2}$$

Where:
K_{sat} = saturated hydraulic conductivity of the soil in cm/min
4.4 = correction factor for a systematic under-estimate of soil permeability in the mathematical derivation of the equation
Q = rate of loss of water from the reservoir in cm^3/min
H = depth of water in the test hole in cm
r = radius of the test hole in cm.

CONSTANT HEAD PERMEABILITY	
Rate of loss of water from reservoir (Q)	7.76cm^3/min
Saturated hydraulic conductivity (K_{sat})	0.0042 cm/min
Indicative permeability (K_{sat})	0.06m/day

Note: The results in the table above are based on average readings taken from the test holes.

The corresponding K_{sat} value of 0.06m/day in EPA Onsite Wastewater Management – Code of Practice Publication No. 891.4 July 2016 Appendix A Table 9 is category 4 (clay loam soil). Therefore a maximum Design Irrigation Rate of 3.5mm/day and Design Loading Rate of 4mm/day has been adopted.

5. LAND CAPABILITY ASSESSMENT MATRIX:

The table below is a Land Capability Assessment (LCA) from The Victorian Land Capability Assessment Framework (2nd Edition 2014). The LCA has been developed for the whole site, however soils information relates to soils within the vicinity of the building envelope.

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	Nil
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	Nil
Fill (imported)	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	Nil
Flood frequency (ARI)	Less than 1 in 100 years	Between 100 and 20 years	More than 1 in 20 years	Nil
Groundwater bores	No bores onsite or on neighbouring properties	Setback distance from bore complies with requirements in EPA Code of Practice 891.4 (as amended)	Setback distance from bore does not comply with requirements in EPA Code of Practice 891.4 (as amended)	Nil
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	Nil
Landslip (or landslip potential)	Nil	Minor to moderate	High or Severe	Nil
Rock outcrops (% of surface)	<10%	10-20%	>20%	Nil
Slope Form (affects water shedding ability)	Convex or divergent side-slopes	Straight side-slopes	Concave or convergent side-slopes	Nil
Slope gradient (%)				
(a) for absorption trenches and beds	<6%	6-15%	>15%	Nil
(b) for surface irrigation	<6%	6-10%	>10%	Nil
(c) for subsurface irrigation	<10%	10-30%	>30%	Nil

Table 3: Risk Assessment of Site Characteristics						
Characteristic	**Level of Constraint**					**Assessed Level of Constraint for Site**
	Nil or Minor		**Moderate**	**Major**		
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 fills with water		Nil
Stormwater run-on	Low likelihood of stormwater run-on			High likelihood of inundation by stormwater run-on		Nil
Surface waters - setback distance (m)	Setback distance complies with requirements in EPA Code of Practice 891.4 (as amended)			Setback distance does not comply with requirements in EPA Code of Practice 891.4 (as amended)		Nil
Vegetation coverage over the site	Plentiful vegetation with healthy growth and good potential for nutrient uptake		Limited variety of vegetation	Sparse vegetation or no vegetation		Minor
Characteristic	**Level of Constraint**					**Assessed Level of Constraint for Site**
	Nil or Minor		**Moderate**	**Major**		
Soil Drainage (Field Handbook definitions)	Rapidly drained. Water removed from soil rapidly in relation to supply, excess water flows downward rapidly. No horizon remains wet for more than a few hours after addition	Well drained. Water removed from the soil readily, excess flows downward. Some horizons may remain wet for several days after addition	Moderately well drained. Water removed somewhat slowly in relation to supply, some horizons may remain wet for a week or more after addition	Imperfectly drained. Water removed very slowly in relation to supply, seasonal ponding, all horizons wet for periods of several months, some mottling	Poorly/Very poorly drained. Water remains at or near the surface for most of the year, strong greying. All horizons wet for several months	Minor

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.

The above risk assessment indicates conventional/standard designs are satisfactory at this site

The table below is a Land Capability Assessment of general and soil characteristics of the site.

Land Features	**Land Capability Class Rating**					**Site Rating**	**Comments**
	Very Good (1)	**Good (2)**	**Fair (3)**	**Poor (4)**	**Very Poor (5)**		
Groundwater table (m) seasonal watertable depth	>5.0	2.5 – 5.0	2.0 – 2.5	1.5 – 2.0	<1.5	1†	-
Exposure	High sun and wind exposure		Moderate	Low sun and wind exposure		1	Site is relatively open
Vegetation Type (land application area)	Turf or pasture				Dense Forest	1	Native grasses and native trees
Rainfall (mm/yr)[2]	<450	450 - 650	650 – 750	750 - 1000	>1000	2	622mm/yr
Pan evaporation (mm/yr)[3]	>1500	1250 - 1500	1000 – 1250	-	<1000	3	1210mm/yr
Profile depth	>2.0m	1.5–2.0m	-	1.0–1.5m	<1.0m	4	Soil over extremely weathered ROCK
Shrinkage* (%)	Low <4%	Moderate 4-12%	High 12-20%	Very High >20%		2	Medium reactive clay soils
Permeability* (m/d)	0.15–0.30	0.08–0.15 0.30-0.60	0.06-0.08 0.60-1.50	- 1.50-2.00	<0.06 >2.00	4	0.06 Constant head method
Soil Permeability Category [1]	2 and 3	4		5	1 and 6	2	Constant head method
Emerson Test* (dispersion / slaking)	4,6,8	5	7	2,3	1	2	Class 5
Electrical Conductivity (Ece) (dS/m)	<0.3	0.3-0.8	0.8-2.0	2.0-4.0	>4.0	1	Non saline
pH	6-8		4.5-6		<4.5, >8	1	Slightly acidic

[1] Source: AS1547-2012
[2] Source BOM station – Yandoit
[3] Source BOM station – Creswick
* Relevant to soil layer(s) associated with wastewater application
† No water table was encountered while drilling the Bore Hole (see engineering log).

6. THE MANAGEMENT PROGRAM:

The following sections provide an overview of our preferred systems and the sizing and design considerations that are involved with these systems.

6.1 Treatment System

Based on the land capability assessment, any of the two following systems are recommended at this site. These are:

6.1.1 Option 1

Primary treatment by septic or vermiculture treatment plus secondary treatment of all wastewaters by either aerated wastewater treatment system, sand filter or similar. Dispose to land via surface irrigation and subsurface drip irrigation.

6.1.2 Option 2

Primary treatment by septic or vermiculture treatment. Dispose to land via trenches.

6.2 Land Applications Areas

6.2.1 Water Balance (Appendix B)

The guidelines, specifically On-site Sewage Management for Single Households - Environment and Health Protection Guidelines, requires a model water balance to be undertaken when sizing irrigation systems. Appendix B contains Excel spreadsheets for subsurface drip irrigation and absorption trenches.

The local climate conditions are based on the weather station at Yandoit which observes monthly rainfall data and Creswick which observes pan evaporation data. A daily wastewater output of 1260L/day was assumed.

Note: Due to the evaporation exceeding the rainfall for each month, a water balance model has been used to assess the design to the various input and output characteristics. This is to ensure the right sized area is used to ensure the soil is not saturated if the area is too small and there is not poor disposal over the area when times are dry.

Therefore the following wastewater envelopes are required with regard to the three options:

Option 1: Subsurface Irrigation Based on Design Irrigation Rate (DIR) of 3.5mm/day

Primary septic treatment or vermiculture treatment plus secondary treatment of all wastewaters by either aerated wastewater treatment system, sand filter or similar. Dispose to land via surface irrigation or subsurface drip irrigation based on water balance calculations:

440m^2 of subsurface irrigation

Pipes and emitters installed generally at a depth of 100mm to 150mm below ground level.

An equivalent reserve area will also be required to be set aside.

Option 2: Absorption Trenches Based on a Design Loading Rate of 4.0mm/day

Primary septic treatment or vermiculture treatment. Dispose to land via trenches based on water balance calculations:

1. 240 lineal metres at 0.6m width,
2. 223 lineal metres at 0.7m width,
3. 184 lineal metres at 1.0m width,
4. 164 lineal metres at 1.2m width, or
5. 116 lineal metres at 2.0m width.

Trenches installed generally at a depth of 300mm to 600mm below ground level.

An equivalent reserve area will also be required to be set aside.

6.3 Sizing of the septic system

The minimum capacity of the septic tank has been calculated as follows.

C = (P x DF) + (S x P x 3)
No food waste disposal units have been allowed for and should not be incorporated into this development.

C = effective capacity in litres
P = Number of people using the system
DF = daily inflow, litres per person per day
S = Sludge and scum rate per person

Therefore:

*C = (*8 *x 180) + (65 x* 8 *x 3)*

C = 3000 *Litres*

Therefore a tank volume of approximately 3000Litres will be required.

The septic tank and maintenance must conform with the EPA Certificate of Approval 1.1/03.

The septic tank and maintenance must conform with the EPA Certificate of Approval 1.1/03.

6.4 Siting and Configuration

Civiltest Pty. Ltd. considers the wastewater envelope area marked on **Figure 2 - Site Plan** to be suitable for wastewater disposal. Set back requirements (see **Appendix C : Buffer Distances**) must be taken into consideration.

6.5 Monitoring, Operation and Maintenance

The requirements of the permit should be adopted and followed. In addition to any other requirements it is required that:

- The septic tank is de-sludged every 3 years

To ensure the AWTS system functions adequately residents must:

- Have a suitably qualified maintenance contractor service the AWTS every three months, as required by Council under the approval to operate.

The requirements of Standards Australia 2008, AS/NZS 1546.3: *On-site domestic wastewater treatment units – Part 3: Aerated wastewater treatment systems.* This requires:

- The wastewater quality meets:
- BOD 20mg/L
- Suspended Solids 30mg/L
- Faecal Coliforms organisms /100ml <10
- Free residual chlorine <2mg/L
- The irrigation area must be a permanent dedicated area within the premises
- The dedicated irrigation area must be cultivated to a depth 100mm, either planted with grasses or salt tolerant plants or mulched.

The irrigation lines may be laid around existing vegetation however, lines must be covered a minimum of 150mm with quality topsoil.

To ensure the treatment systems function adequately, residents must:

- Use household cleaning products sparingly and check that they are suitable for septic tanks.
- Keep as much fat and oil out of the system as possible; and
- Conserve water.

6.6 Storm Water Management

All stormwater must be disposed of to the legal point of discharge.

Note: An agricultural (AG) drain must be installed on the high side of the wastewater envelope. The drain is to be installed a minimum of 100mm into the naturally occurring clay soils and allow sufficient fall to intercept and drain all overland and subsurface run-off to a legal point of discharge. If a legal point of discharge cannot be obtained, the drainage line may discharge directly to the surface soils, a minimum distance of 10 metres beyond the wastewater disposal area.

7. CONCLUSIONS:

From this investigation it is concluded that the use of an on-site wastewater treatment and disposal system is environmentally sustainable if the recommendations made in this report are followed.

The following should also be noted:

- Installation of 3 star rated water fixtures to reduce water use and wastewater loadings.
- Use of low phosphorus and low sodium (liquid) detergents to improve effluent quality and maintain beneficial uses of groundwater.
- Operation and maintenance of treatment and disposal systems in accordance with the manufacturer's recommendations and the recommendations made in this report.

8. REFERENCES:

- Environmental Protection Authority – Guidelines for Environmental Management Code of Practice – Onsite Wastewater Management, July 2016 ~ Publication 891.4
- Municipal Association Victoria (MAV) 2006, Model Land Capability Assessment Report
- The Victorian Land Capability Assessment Framework (2nd Edition 2014)
- Australian/New Zealand Standard AS/NZS 1547-2012 – On-site domestic wastewater management.
- Civiltest Pty Ltd - Field and Laboratory data (where applicable) collected and recorded.
- Environmental Protection Authority - "Code of Practice - Septic Tanks", March 1996" ~ Publication 451.
- Environmental Protection Authority, Information Bulletin- "Land Capability Assessment for onsite Domestic Wastewater Management", March 2003 ~ Publication 746.1.
- Standards Australia 2008, AS/NZS 1546.1: *On-site domestic wastewater treatment units – Part 1: Septic Tanks.*
- Standards Australia 2008, AS/NZS 1546.3: *On-site domestic wastewater treatment units – Part 3: Aerated wastewater treatment systems.*

This report consists of seventeen pages, including three appendices.

Steve Hennig
CIVILTEST PTY LTD

Ref: SH/mg

17 November 2020

APPENDIX A: SOIL PROFILE AND CONDITION

The natural soil profile in the bore hole consisted of SILT overlying silty CLAY followed by extremely weathered ROCK.

The table below represents the engineering log of the bore hole obtained during mechanical augering at the approximate location as shown on the attached plan.

Bore Hole Depth (m)	**Classifi-cation**	**Shear Vane Strength kPa**	**Engineering Log**
0.500	x x x x x x x x		SILT Brown Dry Medium dense Becoming yellow-brown at 0.200
1.200	x x x x x x x x		CLAY, silty Orange brown Moist to dry Very stiff
1.500	o o o o o o o o o o o o o		Extremely weathered ROCK Yellow Dry Low strength **REFUSAL**
			END OF BORE (02/11/2020)

APPENDIX B: WATER BALANCE

Nominated Area Water Balance & Storage Calculations for Surface Irrigation

Owner/Applicant: Made For **Date: 2 Nov 2020**
Site Address: 171 Wilsons Lane YANDOIT
Notes: *Based on MAV & DSE Model LCA Feb 2006*

INPUT DATA				NOTES
Design Wastewater Flow	Q	1260	L/day	Based on wastewater design flows as per Section 4.8 & Table 4.5 of the Septic Tanks Code of Practice 2003.
Design DIR	DIR	24.5	mm/week	Assumes xxx topsoils with xxxx drainage, DIR taken from Table 4.2A4 in AS/NZS 1547:2000
Daily DIR		3.5	mm/day	
Nominated Land Application Area	L	440	m sq	Used for iterative purposes (if desired) to determine storage requirements for nominated areas
Crop Factor	C	0.7-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type
Retained Rainfall	Rf	0.6	unitless	Proportion of rainfall that remains on-site and infiltrates, allowing for any runoff.
Rainfall Data	Yandoit	mean monthly		
Evaporation Data	Creswick	mean monthly		

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 (mean)	R	\	mm/month	34.3	42.6	33.3	42.7	58.8	68	70.4	68	60.5	55.7	45.9	41.8	**622**
Evaporation (mean)	E	\	mm/month	208	185	127	81	50	27	28	43	66	112	129	155	**1210**
Crop Factor	C			0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	
OUTPUTS																
Evapotranspiration	ET	E*C	mm/month	166	148	102	57	35	19	20	30	46	89	103	124	**939**
Percolation	B	(DIR/7)*D	mm/month	108.5	98.0	108.5	105.0	108.5	105.0	108.5	108.5	105.0	108.5	105.0	108.5	**1278**
Outputs		ET+B	mm/month	275	246	210	162	143	124	128	139	151	198	208	233	**2216**
INPUTS																
Retained Rainfall	RR	R*Rf	mm/month	18.87	23.43	18.32	23.49	32.34	37.4	38.72	37.4	33.28	30.64	25.25	22.99	**342**
Effluent Irrigation	W	(Q*D)/L	mm/month	88.8	80.2	88.8	85.9	88.8	85.9	88.8	88.8	85.9	88.8	85.9	88.8	**1045**
Inputs		RR+W	mm/month	107.6	103.6	107.1	109.4	121.1	123.3	127.5	126.2	119.2	119.4	111.2	111.8	**1387**
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	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-167.0	-142.2	-103.1	-52.3	-22.1	-0.6	-0.5	-12.7	-32.0	-78.4	-97.0	-120.7	
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	0.0												
Total volume of storage	V	N*L	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE		Q*D/(ET-RR+B)	m2	153	159	204	273	352	437	437	385	321	234	207	186	

MINIMUM AREA REQUIRED FOR ZERO STORAGE (m2): 437 This is based on the worst month of the year, so the balance overestimates the area/storage requirements and is hence conservative for all the other months

YANDOIT Evap.data **CRESWICK**

Long term Average Rainfall (B. Met. Data)

AS1547 - Table G1 (Prepared by R.A. Patterson, Lanfax Labs. Armidale April 202)

Void space in drainfield = 30%

1			2	3	4	5	6	7	8	9
Month	Days	daily pan	Pan Eo	Et	Rainfall	Retained	LTAR*N	Disposal	Effluent	Size of
	per	Eo		+Cf*Eo	P	Rainfall		rate/month	applied	area
	month	(B.Met)				Re=(1-r)P	4.4	(Et-Re)+	per month	(8)/(7)
								LTAR*N	1260	
		mm	mm	mm	mm	mm	mm	mm	L	m2
Jan	31	6.7	207.7	154	34.3	15.5	136.4	274.6	39060	142
Feb	28	6.6	184.8	137	42.6	19.2	123.2	240.7	35280	147
Mar	31	4.1	127.1	94	33.3	15.0	136.4	215.4	39060	181
Apr	30	2.7	81.0	60	42.7	19.3	132	172.7	37800	219
May	31	1.6	49.6	37	58.9	26.6	136.4	146.5	39060	267
Jun	30	0.9	27.0	20	68	30.7	132	121.3	37800	312
Jul	31	0.9	27.9	21	70.4	31.8	136.4	125.3	39060	312
Aug	31	1.4	43.4	32	68	30.7	136.4	137.8	39060	283
Sep	30	2.2	66.0	49	60.5	27.3	132	153.6	37800	246
Oct	31	3.6	111.6	83	55.7	25.1	136.4	193.9	39060	201
Nov	30	4.3	129.0	95	45.9	20.7	132	206.8	37800	183
Dec	31	5.0	155.0	115	41.8	18.9	136.4	232.2	39060	168
		Total Eo	**1210.1**	**Total P**	**622.1**					

TABLE G2 - Depth of stored effluent First trial - choose from col.9 table above

1	2	3	4	5	6	7				
month	first trial	application	Disposal	(3)-(4)	Increase	Depth	increase	computed	**reset if**	
	area	rate	rate		depth of	effluent	depth	depth	**Et deficit**	
	(m2)	(8)*/(2)	per month		stored	for	effluent	effluent	**<0**	
			(above)'		effluent	month	+(6)	(X)		
					(5)/0.3					
Dec								0.0		
Jan	312	125	275	-149	-498	0	-498	-498	0	
Feb		113	241	-128	-426	0	-426	-426	0	
Mar		125	215	-90	-301	0	-301	-301	0	
Apr		121	173	-52	-172	0	-172	-172	0	
May		125	147	-21	-71	0	-71	-71	0	
Jun		121	121	0	-1	0	-1	-1	0	
Jul		125	125	0	0	0	0	0	0	
Aug		125	138	-13	-42	0	-42	-42	0	
Sep		121	154	-32	-108	0	-108	-108	0	
Oct		125	194	-69	-229	0	-229	-229	0	
Nov		121	207	-86	-285	0	-285	-285	0	
Dec		125	232	-107	-357	0	-357	-357	0	
Jan		125	275	-149	-498	0	-498	-498	0	
Feb		113	241	-128	-426	0	-426	-426	0	
Mar		125	215	-90	-301	0	-301	-301	0	
Apr		121	173	-52	-172	0	-172	-172	0	
May		125	147	-21	-71	0	-71	-71	0	

From calculations in tables above for optimised drainfield area, using Appendix G AS1547-1994

Variables Table **Runoff Coeff = 0.5 percentage runoff**

Crop Factor = 0.7 crop transpiration rate

Change as required **DLR = 4 mm/d**

FLOWS= 1260 L/day

Estimated area of effluent drainfield = 312 square metres

Maximum depth of stored effluent = 0 mm depth

Trench dimensions (mm) **width = 1000** mm **depth = 450** mm

Length of trench required = 184 metres

NOTES:

As a model, the best results are only ESTIMATES of performance.

A model is used to assess SENSITIVITY to changes in the variables and the effect upon application area

Table 2 is run for 16 months to ensure system returns to ZERO at some stage

APPENDIX C: SETBACK DISTANCES

Extract from EPA Code of practice – Onsite Wastewater Management, Table 5:

Landscape feature or structure	Setback distances (m)		
	Primary sewage and greywater systems	Secondary sewage and greywater systems	Advanced secondary greywater systems [3]
Building			
Wastewater field up-slope of building 7	6	3	3
Wastewater field down-slope of building	3	1.5	1.5
Wastewater up-slope of cutting/escarpment 12	15	15	15
Allotment boundary			
Wastewater field up-slope of adjacent lot	6	3	1
Wastewater field down-slope of adjacent lot	3	1.5	0.5
Services			
Water supply pipe	3	1.5	1.5
Wastewater up-slope of potable supply channel	300	150	150
Wastewater field down-slope of potable supply channel	20	10	10
Gas supply pipe	3	1.5	1.5
In-ground water tank 14	15	7.5	3
Stormwater drain	6	3	2
Recreation areas			
Children's grassed playground 15	6	3 16	2 16
In-ground swimming pool	6	3 16	2 16
Surface waters (up-slope of:)			
Dam, lake or reservoir (potable water supply) 8, 13	300	300 4	150
Waterways (potable water supply) 9, 13	100	100 4, 5, 17	50
Waterways, wetlands (continuous or ephemeral, non-potable); estuaries, ocean beach at high-tide mark; dams, reservoirs or lakes (stock and domestic, non-potable) 8, 9	60	30	30
Groundwater bores			
Category 1 and 2a soils	NA11	5019,	20
Category 2b to 6 soils	20	20	20
Watertable			
Vertical depth from base of trench to the highest seasonal water table 18	1.5	1.5	1.5
Vertical depth from irrigation pipes to the highest seasonal water table 18	NA	1.5	1.5

1. Distances must be measured horizontally from the external wall of the treatment system and the boundary of the disposal/irrigation area, except for the 'Watertable' category which is measured vertically through the soil profile. For surface waters, the measuring point shall be from the 'bank-full level'.
2. Primary water-based sewerage systems must only be installed in unsewered areas; secondary sewerage systems must only be installed and managed in sewered areas by Water Corporations; secondary greywater systems can be installed in sewered and unsewered areas.
3. Advanced secondary greywater systems treating effluent to ≤10/10/10 standard.

4. The setback distance in a Special Water Supply Catchment area may be reduced by up to a maximum of 50% conditional on the following requirements (otherwise the setback distances for primary treatment systems apply):

   • effluent is secondary treated to 20/30 standard as a minimum
   • a maintenance and service contract, with a service technician accredited by the manufacturer, is in place to ensure the system is regularly serviced in accordance with Council Septic Tank Permit conditions and
   • Council is satisfied the reduction in set-back distance is necessary to permit the appropriate development of the site and that risks to public health and the environment are minimised.

5. Effluent typically contains high levels of nutrients that may have a negative impact on native vegetation and promote the growth of weeds. When determining setbacks, Council should consider not only the potential impact of nutrients from the proposed onsite wastewater management system, but the cumulative impact of the existing onsite wastewater management systems in the area.

6. Establishing an effluent disposal/irrigation area upslope of a building may have implications for the structural integrity of the building.

7. Does not apply to dams, lakes and reservoirs located above ground-level which cannot receive run-off.

8. Means a waterway as defined in the Water Act 1989.

9. The setback distances for flat land are equivalent to 'down-slope' setback distances.

11. A cutting or escarpment from which water is likely to emanate.

12. Applies to land, adjacent to a dam, lake, reservoir or waterway that provides water for a public potable water supply, which is:

    a. subject to a Planning Scheme Environmental Significant Overlay (ESO) that designates maintenance of water quality as the environmental objective to be achieved (contact the relevant Water Authority to determine whether the ESO is in a potable water supply catchment)
    and/or
    b. within a Special Water Supply Catchment Area listed in Schedule 5 of the Catchment and Land Protection Act 1994.

Note: There is no 13. in source document

14. It is recommended that any primary or secondary treatment system and its associated land application system are installed downslope of an in-ground water tank.

15. Means a school, council, community or other children's grassed playground managed by an organisation which may contain play equipment (but does not mean a sports field).

16. Sub-surface irrigation only.

17. Where an intermittent stream on a topographic or orthographic map is found through ground-truthing to be a drainage line (drainage depression) with no defined banks and the bed is not incised, the setback distance is 40 m (SCA 2010). The topography of the drainage line must be visually inspected and photographed during the LCA site inspection and reported upon in writing and photographs in the LCA report.

18. The highest seasonal watertable occurs when the watertable has risen up through the soil profile and is closest to the ground surface. This usually occurs in the wettest months of the year.

19. The setback distance to a groundwater bore in Category 1 and 2a soils can be reduced to 20m where treated and disinfected greywater or sewage (20/30/10 or better standard) is applied and the property owner has a service contract with an appropriately qualified technician to regularly maintain the treatment system.