Peter Hansen DRAINAGE LTD.

Producer Statement

On-site Wastewater Treatment and Disposal to Land

Prepared For
Mark James Nelson
1604 Cust Road, Cust

Prepared By
Jenna Van Housen
October 2022

Quality Control

Client	Mark James Nelson
Title	On-site Wastewater Treatment and Disposal to Land – 1604 Cust Road, Cust
Author	Jenna Van Housen
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Disclaimer

This report has been prepared for Mark James Nelson. No liability is accepted by Peter Hansen Drainage Ltd with respect to its use by any other person.

This system has been designed to comply with Environment Canterbury's guidelines on effluent disposal and to the best of our knowledge complies fully with their requirements. The design considers the property's specific boundaries, soil type, coliform and nitrate levels, groundwater depth and therefore should have minimal effect on the environment.

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1 INTRODUCTION

Peter Hansen Drainage has been engaged by MJ Nelson to design an on-site wastewater treatment and disposal system for a proposed two-bedroom dwelling, at 1604 Cust Road, Cust.

Due to the small size of the property (less than four hectares), the proposed activity is considered restricted discretionary under Environment Canterbury's Land and Water Regional Plan, and therefore requires resource consent.

2 DESCRIPTION OF THE SITE

The details of the site of the proposed activity are given below:

Property address	1604 Cust Road, Cust
Legal description	LOT 7 DP 73946
Area	0.09 ha
District Council	Waimakariri District Council
Water Supply	Public
Dwelling Size	Two-bedrooms
Daily Effluent Flow	1000 litres/day

A copy of the rates demand is provided in Appendix A.

3 DESCRIPTION OF THE ENVIRONMENT

3.1 Soils and Geology

The applicant's property is located within the Cust township, on top of a ~5-10m terrace above the Cust River.

Landcare Research's SMAP database identifies the soil across the property as a Claremont, moderately deep silt loam with moderate over slow permeability. A 2.8 m deep test pit was excavated on site by Peter Hansen Drainage Ltd in September 2022. The soil profile details are given in Table 1 and Figure 1. Free draining gravels were not reached and groundwater was not observed in the test hole.

Based on the findings, the soils across the site are considered to be category 3-4, moderately well drained silty/clay loams.

Figure 1: 2.8 m deep test hole, 1604 Cust Road, Cust.

Note: Water observed in the base was added as part of soakage testing.

Table 1: Test pit soil profile for 1604 Cust Road, Cust.

Layer	Description	Layer depth (mm)
Topsoil	Top soil	0-200
Subsoil 1	Clay loam	200-1000
Subsoil 2	Buried soil	1000-1100
Subsoil 3	Clay, gravels	1100-2800

3.2 Depth to Groundwater and Groundwater Flow

A search of ECan's database shows there are 14 bores within 1km of the property, however of these only seven are active. The closest active bore to the proposed discharge is BW23/0086, 51.8 m deep located approximately ~260 m North East at the bottom of the terrace.

Of the 14 bores, there are four with recorded high water level readings, as given in Table 2.

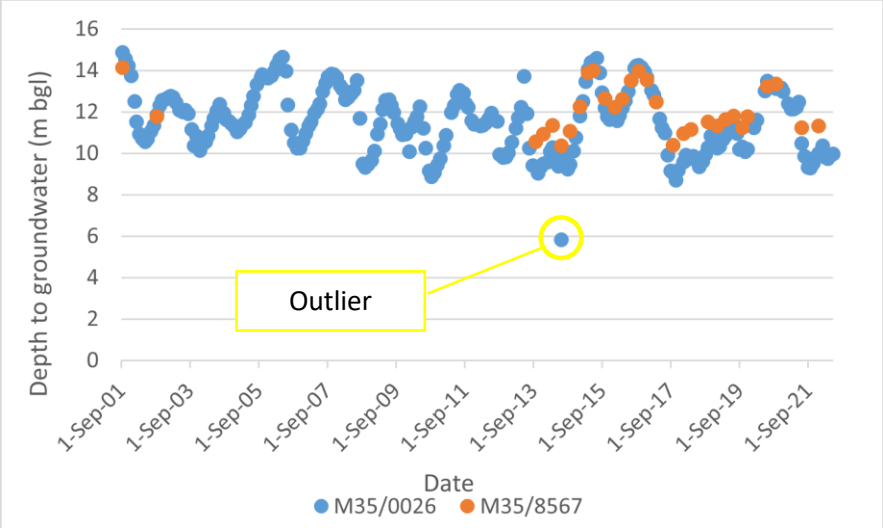
Table 2: High groundwater level well data within 1,000 m of proposed discharge

Bore number	Depth (m)	Highest recorded water level (m bgl)	Reading count	Years readings taken	Distance (m)
M35/8567	15.2	10.37	30	2001-2022	344
BW23/0086	51.8	10.4	1	2014	257
M35/3331	6.1	0.349	1	2012	849
M35/0026	16.8	5.82	604	1950-2022	1000

As discussed, BW23/0086 is deep and located at the bottom of the terrace on the northern side of the Cust River, as is M35/3331, and therefore are unlikely to be directly hydraulically connected to the groundwater beneath the applicant's site.

Based on the data in Table 1 for bores M35/8567 and M35/0026, the high seasonal depth to groundwater is indicated to be 5.82 m bgl. The groundwater level in M35/0026 is generally higher than the water level in M35/8567 but does vary from 1.54 m higher to 0.64 m deeper (Figure 2). The reading of 5.82 m bgl (June 2014) however, was 4.5 m higher than that recoded in well M35/8567 around the same time and is also a clear outlier so has not been used in the assessment of groundwater level. The next highest groundwater reading was 7.1 m below ground level.

Figure 2: Depth to groundwater for bores M35/0026 and M35/8567, 2001-2021



Piezometric contours show groundwater flows from Northwest to Southeast and indicates a groundwater elevation of 120 m above mean seal level. Based on a ground elevation of ~130 m above mean seal level, the long-term median depth to groundwater can be estimated to be ~10 m bgl.

In the direction of groundwater flow, the closest active bore (M35/6458) is located approximately >1700 m away.

3.3 Groundwater Quality

Within a 1km radius of the property, ECan's database shows one bore with recorded groundwater quality readings, which are summarised in Table 3.

Table 3: Recorded water quality data within 1,000 m of proposed discharge

Bore number	Depth (m)	Highest concentration of bacteria in all samples taken	Highest concentration of nitrate nitrogen in all samples taken (mg/l)	Sample count	Years readings taken	Distance (m)
M35/8567	15.2	1 Faecal Coliform (CFU/100ml) 141 Ecoli (MPN/100ml)	12.2 mg/L	51	1999-2022	344 m SW

Based on the findings in Table 3, the likely maximum concentration of nitrate-N in the groundwater surrounding the site is up to 12.2 mg/l. The highest faecal coliform count has been recoded as 1 CFU/100 ml, although E.coli readings have been up to 141 MPN/100 ml, which suggests potential well head security issues.

3.4 Surface water

The Cust River flows 180 m North of the property and forms the closest natural water way to the proposed discharge.

4 ON-SITE WASTEWATER MANAGEMENT SYSTEM

The proposed system comprises a secondary treatment system with treated effluent pumped to a drip field. The proposed locations of the treatment and disposal systems are presented in Appendix B.

4.1 Secondary Treatment

A new Hynds Lifestyle 'Ultimate' tank is proposed. The Hynds 'Ultimate' provides for secondary treatment of the wastewater through the five chambers, has a total operating capacity of 7,200 litres, and a daily treatment capacity of 1,800 litres.

The tank will be fitted with a new audible visual high-water level alarm and Pedrollo Top Multi 2 submersible pump (or equivalent).

The tank has been manufactured and engineer approved to AS/NZS 1546.1:2008.

The results of OSET testing of the Hynds Lifestyle 'Ultimate' tank is given in Appendix C, with a summary in Table 4.

Table 4: Summary of OSET testing results for the Hynds 'Ultimate',

Parameter (unit)	Treated effluent Mean	Treated Effluent Max	Treated Effluent Min
Total Nitrogen (mg/l)	13	19.5	10
Nitrate-N (mg/l	909	16.4	7.4
CBOD5 (gm^{-3})	2.9	5.0	1.0
Faecal Coliform (cfu/100 ml)	$4.2x10^4$	$14.4x10^4$	$0.1x10^4$

4.2 Land application

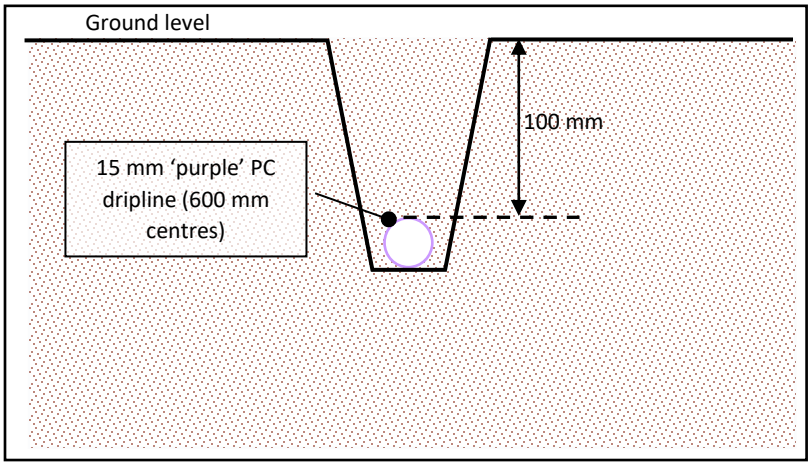
Treated wastewater will be discharged to land via driplines (refer to site plan in Appendix B) in two areas on the property to maximise the application area. It is proposed that 332 m^2 of driplines will be installed, laid 1 m apart. This equates to an application depth of 3.0 mm/d at the maximum discharge of 1,000 l/day. The 15 mm driplines will be buried with 100 mm of topsoil cover (see Table 5 and Figure 3).

Table 5: Proposed Land Application System Details

Type of irrigation lines	Pressure compensating 15 mm drip lines
Total length of irrigation lines	332 m (10 x 24 m + 4 x 23 m)
Distance between irrigation lines	1 m
Spacing between drip emitters	0.6 m
Area of land application system	332 m^2 (See Appendix B)
Application rate	3.0 mm/day
Where will the irrigation lines be installed?	100 mm below ground, with 100 mm soil cover
Will the land application area be planted?	Yes
How will stock/vehicle access be restricted?	Due to the layout and size of the site there is no stock and vehicle access is restricted.

The proposed design is based on AS/NZS 1547 On site Domestic Wastewater Management design flow allowances and loading rates.

Figure 3: Cross section of dripline



4.3 Service Contract

A service contract must be in place for each system and a copy sent to Environment Canterbury and District Council. The service contractor must check tank twice per year and carry out the steps listed in the Resource Consent.

Peter Hansen Drainage Ltd can provide a service contract – Phone 0275 369 331

The Owners Manual, detailing operation and maintenance requirements of the system, is given in Appendix D.

5 ASSESSMENT OF ENVIRONMENTAL EFFECTS

5.1 Nitrogen

As summarised in Table 3, recorded nitrate levels in the groundwater are high, being up to 12.2mg/l surrounding the applicant's site, in excess of the MAV of 11.3 mg/l. Because of this the Hynds 'Ultimate' aerated treatment system is proposed due to the high level of treatment it provides.

For the proposed system, total nitrogen levels should be low at the point treated effluent discharges to groundwater, causing less than minor impact upon groundwater quality. On average the Hynds 'Ultimate' system reduces the total nitrogen of the influent by 84% to an average of 13 mg/l (Table 4, Appendix C), and nitrate-N to 9.9 mg/l.

Average annual loading of nitrogen to groundwater can be estimated using the wastewater TN output value of 13 mg/l for proposed systems, as follows:

Proposed system: 13 mg/l x 1000 l/d x 365 days = 4.7 kg/yr

Dakers (2017)[a] has reported the potential for plant uptake and denitrification rates in the soil of up to 25%. If applied, the total N loading rate would reduce to 3.6 kg/yr

Due to the high level of treatment proposed, there is unlikely to be a more than minor effect on groundwater quality in the area from the proposal, with a likely improvement in groundwater quality.

5.2 Pathogens

The faecal coliform concentration of the untreated effluent is in the order of 10^{6}-10^{8} MPN/100 ml (USEPA, 2002[b]; Auckland Council, 2021[c]).

As presented in Table 4, OSET testing results gave a mean treated effluent faecal coliform concentration of $4.2x10^{4}$ cfu/100 ml. Using Log reduction, the concentration of faecal coliforms at the high groundwater level and at the closest domestic bore in the direction of groundwater flow (M35/6458, 1700 m SE) can be estimated, the assessment for which is provided in Table 6. A high groundwater level of 7.1 m bgl has been used.

Table 6: Faecal Coliform (FC) assessment to determine FC concentration (cfu/100 ml) in groundwater

	Mean	Min	Max
Hynds treated FC concentration (Table 4)	42,000	1000	144,000
Spatial log reduction in clay soil Log10/m	0.1[d]		
Log reduction through 1.1 m soil	0.11		
Spatial Log reduction in vadose zone (taken to be from 1.1 m bgl to the groundwater table 7.1 m) Log10/m	0.1[e]		
Log reduction in 6 m vadose zone	0.6		
FC concentration at the water table	***8189***	***195***	***28078***
Spatial Log reduction in saturated zone (Log10/m)	0.01[d]		
Log reduction in saturated zone to closest domestic bore (1700m)	17		
FC concentration at closest bore	***<1***	***<1***	***<1***

The assessment in Table 6 is conservative as it is based on the high seasonal water table, however the risk to neighbouring bores was found to be no more than minor with a potential FC concentration of <1

Based on the assessment in Table 6, the estimated FC concentration in groundwater is <1 at the closest neighbouring bore, and therefore the potential effects on the underlying groundwater will be no more than minor.

[a] Dakers, A., 2017, *Assessment of the relative nitrogen risks from an OWMS*, ecoEng Technical Information Sheet NR170529

[b] USEPA, 2002, *Onsite Wastewater Treatment Systems Manual*. EPA/625/R-00/008

[c] Auckland Council, 2001, *On-site Wastewater Management in the Auckland Region* (GD06)

[d] Leonard, M and Pang, L, 2006, *Approaches for Assessing Bacterial Removal in Soils*. Report prepared by ESR for Marlborough District Council, Report No. FW0642.

[e] Pang L. 2009, *Microbial removal rates in subsurface media estimated from published studies of field experiments and large intact soil cores*. J Environ Qual. 2009 Jun 23;38(4):1531-59

6 CONSIDERATION OF ALTERNATIVES

Within the area there is no reticulated system available, therefore an on-site treatment system is required. The Hynds Ultimate aerated system and drip field have been designed in accordance the Onsite Wastewater: Designs and Management Manual TP58 created by the Auckland Regional Council.

The Hynds Ultimate system is considered to be the most suitable option, taking into consideration existing groundwater conditions, the site topography and soil type, along with preferences of the landowner. The discharge is domestic wastewater only, treated to a high standard within the aeration and filtering tank, followed by land treatment. The property is not within a lake, coastal or riverbed area, and the discharge areas are set back sufficiently from boundaries, wells, streams and artificial waterways.

Due to the lack of soakage being observed at a reasonable depth, discharge via a sand trench is not considered appropriate or practical.

7 APPENDICES

Appendix A: Property Title, 1604 Cust Road, Cust

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB42D/208**
Land Registration District	**Canterbury**
Date Issued	27 February 1997

Prior References
CB41C/1223

Estate	Fee Simple
Area	850 square metres more or less
Legal Description	Lot 7 Deposited Plan 73946

Registered Owners
Mark James Nelson

Interests

A254363.8 Transfer creating the following easement in gross

Type	Servient Tenement	Easement Area	Grantee	Statutory Restriction
Convey water	Lot 7 Deposited Plan 73946 - herein	Part herein	Waimakariri District Council	

The easement granted by Transfer A254363.8 is subject to Section 243 (a) Resource Management Act 1991

A254363.9 Transfer creating the following easement in gross

Type	Servient Tenement	Easement Area	Grantee	Statutory Restriction
Electric power	Lot 7 Deposited Plan 73946 - herein	Part herein	Mainpower New Zealand Limited	

The easement granted by Transfer A254363.9 is subject to Section 243(a) Resource Management Act 1991

930471.1 Transfer creating the following easements

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right to convey water, electrical power and telephonic communications	Lot 7 Deposited Plan 73946 - herein	Part herein	Lot 3 Deposited Plan 43485 - CT CB22B/566	

A284532.9 Easement Certificate specifying the following easement - 27.2.1997 at 10.35 am

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Drain water	Lot 8 Deposited Plan 73946 - CT CB42D/209	-	Lot 7 Deposited Plan 73946 - herein	

The easement specified in Easement Certificate A284532.9 when created will be subject to Section 243(a) Resource Management Act 1991

A284532.13 Transfer creating the following easement in gross - 27.2.1997 at 10.35 am

Type	Servient Tenement	Easement Area	Grantee	Statutory Restriction
Convey water	Lot 7 Deposited Plan 73946 - herein	Part herein	Waimakariri District Council	

The easement granted by Transfer A284532.13 is subject to Section 243 (a) Resource Management Act 1991

A284532.15 Transfer creating the following easement in gross - 27.2.1997 at 10.35 am

Type	Servient Tenement	Easement Area	Grantee	Statutory Restriction

Transaction Id
Client Reference *164030-1 Nelson*

Search Copy Dated 24/01/20 12:13 pm, Page 1 of 3
Register Only

Appendix B: Site plan for 1604 Cust Road, Cust

Site plan of Land application system for 1604 Cust Road, Cust
MJ Nelson
LOT 7 DP 73946 Section size: 0.09 ha

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N

0 0 0.01 0.01 0.01 Kilometres

Scale: 1:200 @A3

Map Created by Canterbury Maps on 28/09/2022 at 1:16 PM

Appendix C: OSET results for Hynds 'Ultimate' wastewater treatment system

5 **Test Results**

Flow to the Hynds Lifestyle 'Ultimate' wastewater treatment system commenced on 16 October 2007. Sampling occurred from 26 October 2006 through to 26 July 2007.

The TN evaluation period is from 12 January 2007 to 20 April 2007. This is a period of 99 days. Nitrogen test results are based on data from sampling about every six days over the evaluation period. The above period was chosen for TN evaluation of this system as it reflects the best TN reduction performance over 16 consecutive samples.

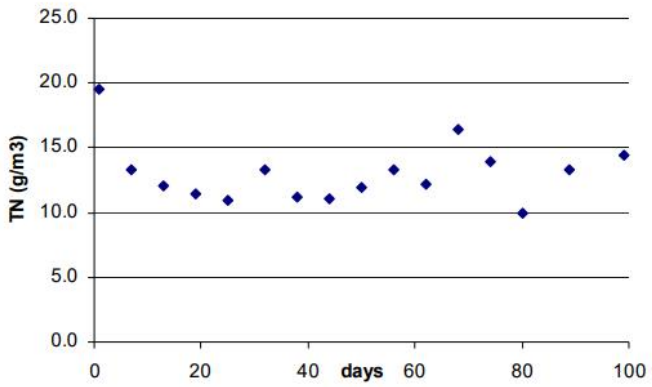
The average measured flow to this system over the TN evaluation period was 934 litres per day.

Table 1 displays total nitrogen influent and effluent results for the evaluation period. 14 of the 16 effluent results over the evaluation period are 15 gm-3 or less with the average being 13 gm-3. Based on the average of the 99 day evaluation period result, the system reduced nitrogen by 84%.

Table 1 Summary of total nitrogen results over the TN evaluation period

Date	Day	Influent (gm^{-3})	Effluent (gm^{-3})	Parameter	Influent (gm^{-3})	Effluent (gm^{-3})
12-Jan-07	1	78.5	19.5	n	16	16
18-Jan-07	7	82.1	13.3	mean	84.0	13.0
24-Jan-07	13	101.9	12.1	median	83.7	12.7
30-Jan-07	19	69.9	11.5	SD	27.6	2.3
5-Feb-07	25	85.4	10.9	Max	162.4	19.5
12-Feb-07	32	93.3	13.3	Min	45.0	10.0
18-Feb-07	38	48.8	11.1	lower quartile	68.3	11.4
24-Feb-07	44	96.4	11.1	upper quartile	94.7	13.5
2-Mar-07	50	69.4	12.0			
8-Mar-07	56	162.4	13.3			
14-Mar-07	62	109.3	12.2			
20-Mar-07	68	50.7	16.5			
26-Mar-07	74	94.1	13.9			
1-Apr-07	80	45.0	10.0			
10-Apr-07	89	91.2	13.3			
20-Apr-07	99	65.0	14.4			
	Average	**84.0**	**13.0**			
Average TN Reduction			**84%**			

Figure 1 Graph of total nitrogen results over the TN evaluation period



5.1 BOD_5[1], Faecal Coliform and TSS Test Results

Three one week (7 day) duration test periods at week 8, week 16, and week 25 were delineated for testing BOD_5, TSS, FC and TN.

[1] Note that the BOD values are likely to be lower than those presented in table 2, due to treating results lower than the detection limit as being at the upper limit of detection.

Table 2 Average influent and effluent results over seven days for weeks 8, 16 and 25

Influent	CBOD5 (gm^{-3})	FC cfu/100mL	TSS (gm^{-3})	TN (gm^{-3})
Wk 8	532	1.5×10^7	1692	70.1
Wk 16	246	3.7×10^7	705	78.9
Wk 25	423	2.8×10^7	1768	105.8

Efluent	CBOD5 (gm^{-3})	FC cfu/100mL	TSS (gm^{-3})	TN (gm^{-3})
Wk 8	1.9	1.5×10^4	2.3	18.1
Wk 16	3.7	9.0×10^4	10.4	12.3
Wk 25	3*	1.2×10^4	9.7	12.5

* based on week 38 data

Efluent	CBOD5 (gm^{-3})	FC cfu/100mL	TSS (gm^{-3})
Mean	2.9	4.2×10^4	7.4
Median	3.0	2.3×10^4	6.2
SD	1.2	4.8×10^4	5.3
n	21.0	20	18.0
Minimum	1.0	0.1×10^4	1.6
Maximum	5.0	14.4×10^4	17.9
Lower Quartile	2.0	0.8×10^4	2.6
Upper Quartile	4.0	9.2×10^4	12.3

Appendix D: Owners Manual

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AS THE OWNER OF THIS SEPTIC TANK AND EFFLUENT SYSTEM, YOU ARE RESPONSIBLE FOR ITS OPERATION AND MAINTENANCE. AFTER THE SYSTEM HAS BEEN OPERATING FOR 1-3 WEEKS YOU WILL NEED TO HAVE THE SYSTEM COMMISIONED AND SET UP A SERVICE CONTRACT.

LIFE OF SYSTEM

1. Effluent Field and Septic Tank area It is imperative that these areas are fenced from stock and other traffic.
2. Pump The pump is a mechanical item and with maintenance should last at least 5 years (if required).
3. Drains and Septic Tank These should last 50 years.
4. Septic Tank/Pump Chambers Concrete septic tanks should last at least 50 years.
5. Effluent Field The life of the effluent field is dependent on many variables. Some are listed below:
   a) The types of other products flushed into the system, (what kills bugs in the house will kill bacterial bugs in the septic tank).
   b) Volume of effluent discharged per day.
   c) What type of detergents used.
   d) Volume of solid particles discharged.
   e) The maintenance of the system.
   f) High rainfall.
   g) Ground Water height.

The life of your system will depend on how you as an owner treat it.

1. Limit the amount of water that goes through your system.
2. Limit the amount of excess food off plates that goes down your drains.
3. Use biodegradable cleaners, synthetic powders and soaps.
4. Do not use standard soaps.
5. Do not flush down your sinks or toilets: napi-san, nappies, wipes, condoms, tampons, pads, disinfectants, medicine, powerful bleach, fat, oils or petrol etc.
6. Do not install a garbage disposal system.
7. **If you sell the property please give the new owners these instruction.**
8. **Set up a maintenance/service contract – Phone Peter Hansen Drainage Ltd, 0275 369 331**

For further details on how to maintain your system please contact your service company.