Brief report on the implications of additional nutrient loss mitigation for water quality

Prepared for Cashmere Bay Dairy Limited

25 July 2019

LANDPRO
Make the most of your land

Cromwell
13 Pinot Noir Drive
PO Box 302
Cromwell 9342
+64 3 445 9905

Gore
23 Medway Street
Gore 9710
+64 3 208 4450

New Plymouth
46 Vivian Street
New Plymouth 4342
+64 6 769 5631

0800 023 318
info@landpro.co.nz
www.landpro.co.nz

Telarc. Registered
Quality ISO 9001

Prepared For

Cashmere Bay Dairy Limited

Prepared By

Landpro Ltd

13 Pinot Noir Drive

PO Box 302

Cromwell

Tel +64 3 445 9905

QUALITY INFORMATION

Reference:	18106
Date:	25 July 2019
Prepared by:	Mike Freeman
Reviewed by:	Matilda Ballinger
Client Review:	George Raymond
Version Number:	**Final**

1 Background and purpose

1.1 The Cashmere Bay Dairy Limited resource consent application is being made to authorise the addition of 80 ha to the existing dairy farm with no additional cows.

1.2 Further nutrient loss mitigation has been modelled and the associated changes have been agreed to by Cashmere Bay Dairy Limited. The purpose of this brief report is to firstly, clarify that additional mitigation is proposed and secondly, to assess the significance of the additional mitigation for water quality in the context of the current application including the AEE and the report prepared by Dr Clint Rissman and Dr Lisa Pearson dated 25 June (Rissman report).

2 Summary of proposed vs current contaminant losses

2.1 The AEE included the following summary of the current vs proposed scenarios in terms of nitrogen (N) and phosphorus (P) losses. Additional mitigation has been agreed to by Cashmere Bay Dairy and modelled by Brian Goodger, Fonterra (see attached report). The following table provides a summary of results for the current and proposed farm systems, with both previous budgeting with ('Legacy') Overseer 6.3.1

Table 1: Original AEE summarised Overseer predicted results from the current and proposed nutrient budgets (Source: Attached Overseer Nutrient Budgets).

	Current farm system		Proposed farm system old		Proposed farm system with additional mitigation
	Overseer 6.3.1	OverseerFM	Overseer 6.3.1	OverseerFM	OverseerFM
N (Kg/yr)	19,757	19,496	19,668	19,599	17,874 (-8.3%)
P (Kg/yr)	299	298	317 – 25 = 292	317 – 25 = 292	296 – 25 = 271 (-9%)

2.2 The proposed mitigation would result in an estimated overall 8.3 % reduction in N loss and 9% reduction in P loss. It is accepted that within this there will be a small increase in nutrient losses from the Sheep Block. However, as indicated in the Rissman report any significant drainage through to the creek/stream network from the Sheep Block alone is highly likely to be limited to the winter/early spring period when dilution will be at a maximum.

2.3 The base files for the current farm have not changed from those that have been audited under legacy Overseer 6.3.1.

2.4 Note that there are some small changes in Overseer loss estimates going from "legacy" Overseer 6.3.1 to OverseerFM. While the "engine" in OverseerFM is the same as in "Legacy" Overseer 6.3.1, there are many complex sub-models that connect to the central "engine" and

often have additional interconnections. It is likely that with the changes involved in moving to OverseerFM there have been some small model changes that have resulted in these small differences. In addition to the Overseer modelling additional P loss mitigation is included as detailed in the original AEE.

3 Summary of proposed mitigation and conditions

3.1 The following is a brief summary of the proposed additional mitigation. Details are in Attachment 1.

- Large Rotorainer irrigation replaced with two new centre pivots and all three pivots using soil moisture probes to schedule irrigation events based on soil moisture levels (see Attachment 2 with proposed irrigation layout, that also includes a possible fourth pivot).
- Small Rotorainer to be removed completely which will reduce overall irrigation area down from 186 ha currently to proposed 143ha.
- Of the 34ha currently sown into fodder beet, around 20ha on the dairy platform to be re-sown each season in the late winter early spring into catch crops, to soak up urinary N deposited from intensive grazing of crops.

3.2 This additional mitigation goes well beyond accepted good management practices in Southland.

3.3 The applicant proposes to be bound by an appropriately worded condition that would require all the proposed mitigation to be operational within two years of the date of resource consent commencement.

4 Effects on water quality

4.1 The effects of a significant reduction in N and P loading to groundwater and surface water respectively are highly likely to be extremely small improvements in water quality. It is accepted that the small increase in nutrient losses from the Sheep Block could conceivably be isolated from the wider property nutrient losses and result in a localised discharge of increased nitrogen or phosphorus. However, as indicated in the Rissman report any significant drainage through to the creek/stream network from the Sheep Block alone is highly likely to be limited to the winter/early spring period when dilution will be at a maximum.

4.2 The improvements in water quality are unlikely to be measurable but if combined with similar improvements from properties in this area are highly likely to result in measurable improvements in both groundwater quality and the quality of the Mataura River.

Attachment 1. Updated Overseer modelling by Brian Goodger

Cashmere Bay Dairy Limited – Otama Farms
Modelled results from three base line files (through OverseerFM)

	15/16	**16/17**	**17/18**	**Average**
Peak Cows	1000 (2.4/ha)	950 (2.2/ha)	960 (2.4/ha)	970 (2.3/ha)
Total N Loss (kg)	20101**	17473**	20916	19496
N Loss/ha (kg)	45	39	40	41
Total P Loss (kg)	296***	289***	311	298
P Loss/ha (kg)	0.6	0.6	0.6	0.6
Pasture Grown Kg/DM/ha/yr (Dairy Platforms)	18,666 (irrigated) 14000 (non-irrigated)	17766 (irrigated) 13326 (non-irrigated)	18892 (irrigated) 14170(non-irrigated)	18441 13832

Table 1

** Includes 982kg total N loss from sheep 17/18 added

*** Includes 14kg total P loss from sheep 17/18 added

Original Pro-posed Dairy Unit
Through OverseerFM

	Proposed Dairy Unit
Peak Cows	1000 (2.0/ha)
Total N Loss (kg)	19599
N Loss/ha (kg)	37
Total P Loss (kg)	317
P loss/ha (kg)	0.6
Pasture Grown Kg/DM/ha/yr	17545 (irrigated) 13159 (non-irrigated)

Table 2

Total N loss increase at average of three years base files from 19496kg N to 19599kg N a 0.5% increase and total P increased from 298kg P to 317kg P a 5.9% increase but remained at 0.6kg P/ha.

Contacted OverseerFM to explain the reasons why xml files pulled through to OverseerFM showed decreases in total N loss by varying amounts over the three base files and the original pro-posed budgets, but have not received a reply.

Pro-posed Dairy Unit- further mitigations
Changes were made to the original pro-posed farm scenario to further reduce total N and P from the average of the three base files (shown in Table 1) they included;

1) Large Rotorainer irrigation replaced with two new center pivots and all three pivots using soil moisture probes to schedule irrigation events based on soil moisture levels (% of PAW or profile available water). More efficient use of water to decrease drainage of nutrients through the soil profile.
2) Small Rotorainer to be removed completely which will reduce overall irrigation area down from 186.41ha currently to pro-posed 143ha
3) Of the 34ha currently sown into fodder beet, around 20ha on the dairy platform to be re-sown each season in the late winter early spring into catch crops, to soak up urinary N deposited from intensive

grazing of crops. This will be possible with new technology that has been introduced in the form of a one pass Spade drill, crops can be sown on bare ground when cows are still grazing nearby crop. Crops have been sown at Lumsden as early as June/July, also trial work is also being undertaken by Plant & Crop and Lincoln University at Lumsden. Cashmere Bay Dairy plan to sow catch crops this winter in July with the use of this drill.

For the purpose of the pro-posed nutrient budget 10ha of grazed fodder beet crop were re-sown into Oats in August and 10ha re-sown into Oats in September. It was entered this way as currently you cannot enter a sowing event and a grazing event together into Overseer for the same months. The only way to successfully model the use of catch crops would to have numerous small blocks, in the future Overseer are to make changes to allow catch crops to be successfully modelled (from Peter Carey Lincoln Agritech) . When this is done catch crops will be able to be entered as sown as early as June/July if conditions are suitable.

Pro-posed Mitigations the Dairy Unit

	Proposed Dairy Unit
Peak Cows	1000 (2.0/ha)
Total N Loss (kg)	17874
N Loss/ha (kg)	34
Total P Loss (kg)	296
P loss/ha (kg)	0.6
Pasture Grown Kg/DM/ha/yr	17462 (irrigated) 13097 (non-irrigated)

Table 3

The pro-posed scenario shows a decrease of total N loss from 19496kg N (table 1) down to 17874kg N (table 3) an 8.3% decrease or an average of 41kgN/ha/yr down to 34kgN/ha/yr.

Total P decreased from 298kg P to 296kg P a 0.6% decrease with P loss /ha remaining the same at 0.6kgP/ha/yr

The Following Farm Map (Map 1) shows the new farm management blocks used to produce the OverseerFM blocks.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Supply Nu	Block Name	Block Area (ha)	Block Type	Part of Far	Sibling Na	Soil Order	Soil Draina	PAW60	PAW100	Mole/Tile	Artificial D	Topograph	Comments	
2	33254	House	0.6	House	Dairy Farm	Balm_21a	Brown Soi	Well drain	64.2	68.5	No	0	Flat		
3	33254	House	0.3	House	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
4	33254	House	0.1	House	Dairy Farm	Eure_23a.	Gley Soils	Poorly dra	164.9	196.7	No	0	Flat		
5	33254	Laneway	0.8	Riparian	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
6	33254	Effluent Pond	0.3	House	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
7	33254	Sheds	1.1	House	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
8	33254	Laneways	1.2	Riparian	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
9	33254	Laneways	0.5	Riparian	Dairy Farm	Balm_21a	Brown Soi	Well drain	64.2	68.5	No	0	Flat		
10	33254	Laneways	0.3	Riparian	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
11	33254	Dairy	0.7	House	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
12	33254	Dairy	0.2	House	Dairy Farm	Eure_23a.	Gley Soils	Poorly dra	164.9	196.7	No	0	Flat		
13	33254	Laneway	0.8	Riparian	Dairy Farm	Eure_23a.	Gley Soils	Poorly dra	164.9	196.7	No	0	Flat		
14	33254	Laneway	0.6	Riparian	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
15	33254	RO House & Sheds	1.9	House	Dairy Farm	Clar_33a.	Pallic Soils	Poorly dra	98.6	98.6	No	0	Flat		
16	33254	RO House & Sheds	1.8	House	Dairy Farm	Clar_33a.	Pallic Soils	Poorly dra	98.6	98.6	No	0	Flat		
17	33254	RO Trees	1.8	Trees and	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
18	33254	Riparian	1.6	Riparian	Dairy Farm	Eure_23a.	Gley Soils	Poorly dra	164.9	196.7	No	0	Flat		
19	33254	Riparian	0.7	Riparian	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
20	33254	Pivot Effluent & Water	24.6	Effluent	Dairy Farm	Eure_23a.	Gley Soils	Poorly dra	164.9	196.7	No	0	Flat		
21	33254	Pivot Effluent & Water	3	Effluent	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
22	33254	Pivot Water & Cobra Effluent	1.1	Effluent	Dairy Farm	Eure_23a.	Gley Soils	Poorly dra	164.9	196.7	No	0	Flat		
23	33254	Cobra Effluent, No Water	31	Effluent	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
24	33254	Cobra Effluent, No Water	16.7	Effluent	Dairy Farm	Balm_21a	Brown Soi	Well drain	64.2	68.5	No	0	Flat		
25	33254	Cobra Effluent, No Water	7.1	Effluent	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
26	33254	New Pivot, Cobra Effluent	74.4	Effluent	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
27	33254	New Pivot, Cobra Effluent	22.5	Effluent	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
28	33254	2nd New Pivot	9.2	Pastoral	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
29	33254	2nd New Pivot	8.2	Pastoral	Dairy Farm	Clar_33a.	Pallic Soils	Poorly dra	98.6	98.6	No	0	Flat		
30	33254	Main Pasture Flat	73.9	Pastoral	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
31	33254	Main Pasture Flat	54.6	Pastoral	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
32	33254	Main Pasture Flat	15.5	Pastoral	Dairy Farm	Clar_33a.	Pallic Soils	Poorly dra	98.6	98.6	No	0	Flat		
33	33254	Main Pasture ,Rolling	67.1	Pastoral	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Rolling		
34	33254	Main Pasture ,Rolling	12.3	Pastoral	Dairy Farm	Pyr2_1a.1	Pallic Soils	Well drain	76.5	85.6	No	0	Rolling		
35	33254	RunOff	37.3	Pastoral	Dairy Farm	Selw_50a.	Recent So	Well drain	163	255.1	No	0	Flat		
36	33254	RunOff	37.3	Pastoral	Dairy Farm	Clar_33a.	Pallic Soils	Poorly dra	98.6	98.6	No	0	Flat		
37	33254	RunOff	15	Pastoral	Dairy Farm	Morv_7a.	Brown Soi	Well drain	59.9	59.9	No	0	Flat		
38															

Attachment 2 Proposed irrigation layout (including a fourth possible future pivot)